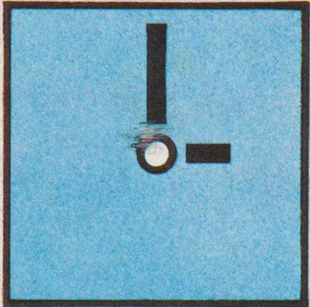
MICRO COMPUTER PRINTOUT

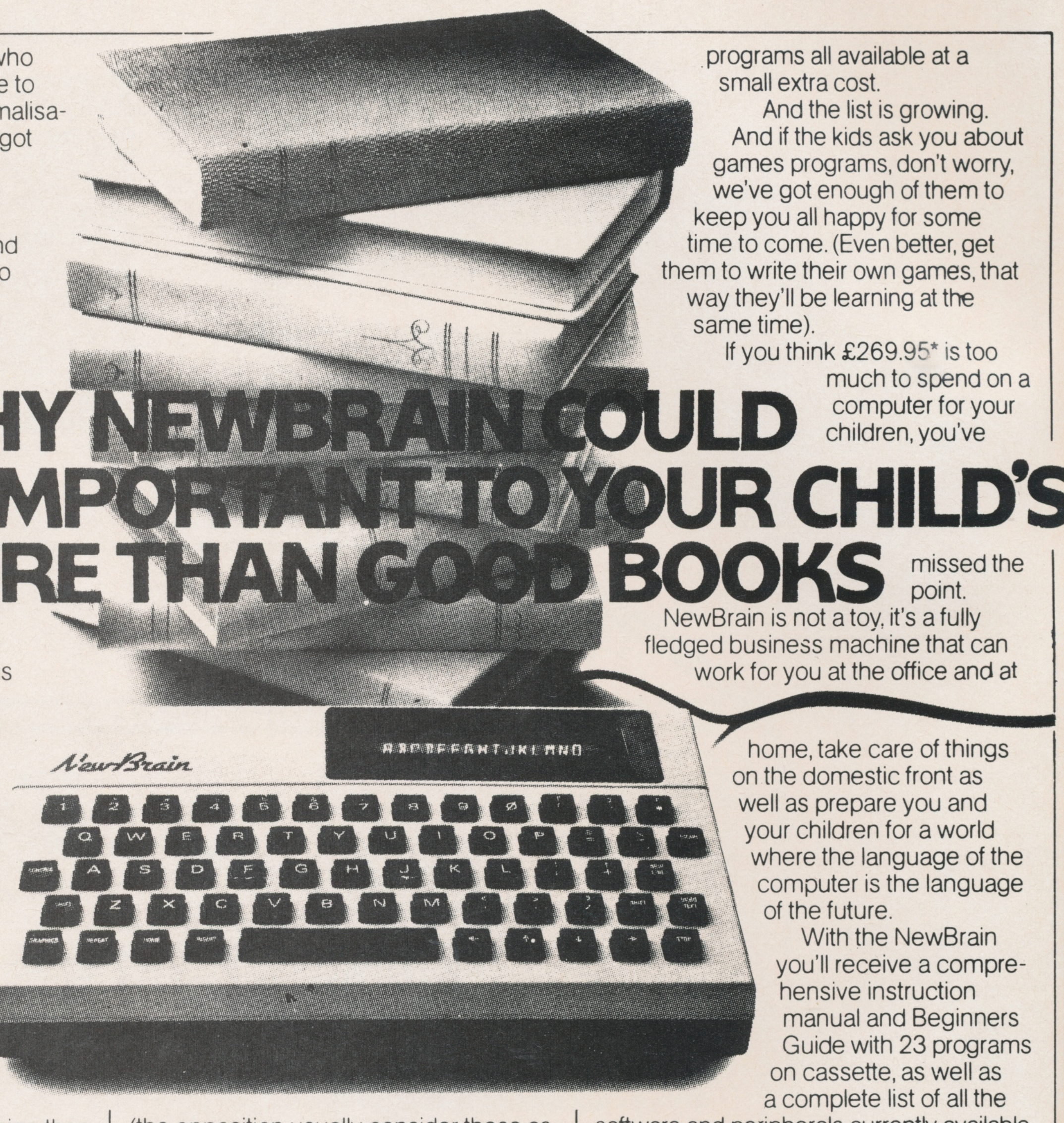
A PLAIN MAN'S GUIDE TO PERSONAL COMPUTING

WINCHESTER DISKS all you need to know



APRIL 1983 95p

APPLE'S LISA works the way you do



WHY NEWBRAIN COULD BE MORE IMPORTANT TO YOUR CHILD'S FUTURE THAN GOOD BOOKS

If you're one of those people who knows how many pecks there are to the bushel and remembers decimalisation as if it were yesterday, we've got some important news for you.

A lot has changed since your schooldays.

New maths, Venn diagrams and the decimal point have come onto the scene.

Now computers are here. And like it or not, they're here to stay.

So much so that they're now an approved part of primary and secondary education (approved by the Department of Industry no less).

And in the future, the emphasis is going to shift more and more towards computer technology and further away from traditional schoolroom aids.

So the money you would normally have spent on a good set of encyclopaedias for your children would now be more effectively spent on one of the new breed of personal computers.

Which is why it's worth doing your homework on NewBrain.

Quite simply, it is more powerful, has more possibilities and allows for greater expansion than any other personal computer in its price range. (It costs £269.95*).

Technical Specifications

The NewBrain is a fully specified professional computer built to the highest standards of engineering and reliability. Chosen by leading OEM suppliers. Designed to facilitate easy expansion for use with the CP/M* operating system, and the addition of 5¼" flexible and Winchester disks, 12" green phosphor professional standard monitor, 80 cps professional quality dot matric printer with pin addressable graphics.

Z80A cpu and COP 420M input/output micro-processors. 32K RAM expandable to 2 Mbytes. 28K ROM. Dual Cassette Ports. UHF TV port. CCITT Monitor Port Video 40/80 Character x 25/30 lines. 256,320,512,640 x 250 Pixels. Expansion Port. V24 Bi-directional Port. V24 Printer Port. 16-character display.

Software:

Enhanced BASIC (ANSI x 3.2/78) Independent Operating System (12 device drivers). Multi Page Screen Editor (32 Control Commands). Maths (10 Significant Figures). Graphics (Absolute & Relative Plotting, Line & Arc Drawing, Shading, 20 English Language Commands).

Take its memory for a start.

It comes with 32K RAM as standard (most competitors expect you to make do with 16K).

And its 28K ROM (the computer's pre-programmed memory) means that you get software packages like screen editing, maths, BASIC and graphics built in (the opposition usually consider these as optional extras).

Its graphics and video capabilities are second to none and its full-sized keyboard (just like the one on a typewriter) means that even the stickiest little fingers won't have any trouble getting to grips with its advanced capabilities.

As we said, when it comes to expansion, you'd have to go a long way to find a machine with the same possibilities.

With the memory expansion modules you can build all the way up to a staggering 2M bytes RAM (a figure that wouldn't look out of place on a computer costing ten times as much).

There are printers, monitors, floppy disc drives and 5¼" Winchester drives (don't worry if these terms seem a little unfamiliar at the moment, before long they'll be part of your everyday language).

And, of course, there's an extensive choice of optional software packages.

There are language learning programs, such as French and German vocabulary, data base programs and accounting programs all available at a small extra cost.

And the list is growing.

And if the kids ask you about games programs, don't worry, we've got enough of them to keep you all happy for some time to come. (Even better, get them to write their own games, that way they'll be learning at the same time).

If you think £269.95* is too much to spend on a computer for your children, you've missed the point.

NewBrain is not a toy, it's a fully fledged business machine that can work for you at the office and at home, take care of things on the domestic front as well as prepare you and your children for a world where the language of the computer is the language of the future.

With the NewBrain you'll receive a comprehensive instruction manual and Beginners Guide with 23 programs on cassette, as well as a complete list of all the software and peripherals currently available.

So if you'd like to know more, simply ask for a brochure and we'll send it by return of post together with the name and address of your nearest stockist.

After all, the price of a stamp can't be too much to pay for something as important as your child's future.

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P.T.O. for more info!

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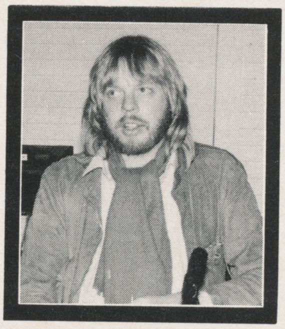

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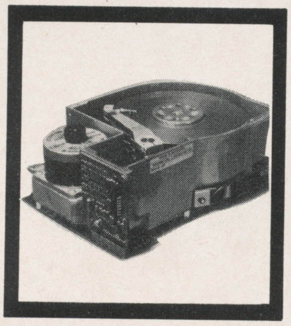

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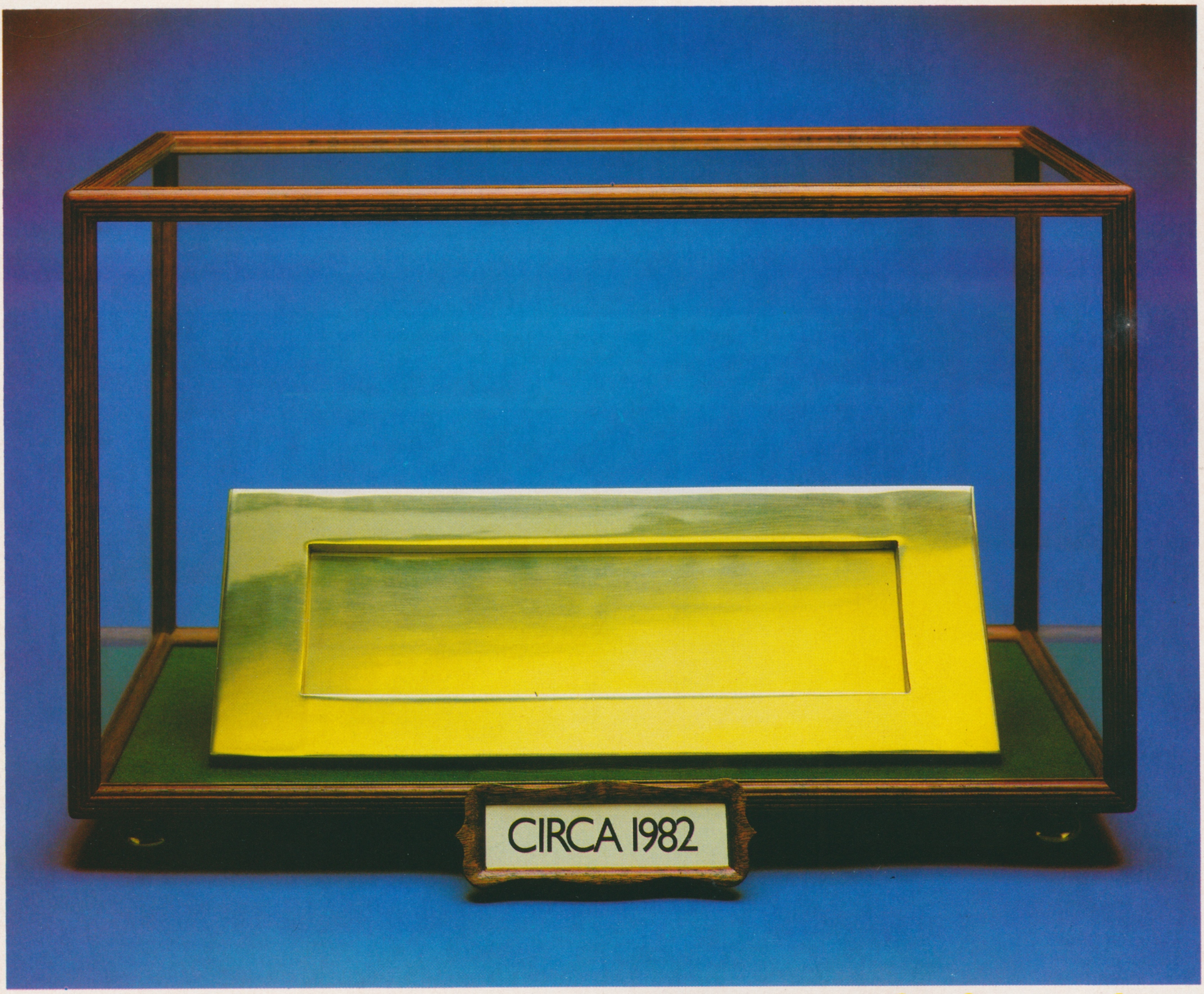
COVER STORY

87 **Apple's LISA** works the way you do because the screen portrays your desktop, and every action you make is shown visually. This month's *Expert's Choice*, takes a long look at this exciting microcomputer, and why other manufacturers are now racing to produce a competitor.



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FRONTLINE

The real significance of LISA

There is more to this Apple LISA thing, than first meets the eye. Last month I described it as a ray of hope; but the more I learn of it's capabilities and marketing, the more I am convinced it represents a major turning point in the development of microcomputers.

'User-friendly' is a term that has been badly abused by the micro marketeers. In the majority of advertisements where you see it quoted, the following phrase could safely be substituted: "Because our software is so complex that you are unlikely to understand what you are doing all of the time, we have built in certain checks and safeguards to prevent you from screwing things up". User-friendly *should* mean that the system works so closely to your own methods that you won't have much difficulty adapting.

The LISA *is* user-friendly, and for one simple reason. The designers have cottoned on to a truism that Marshall McLuhan was proclaiming in the 1960s: that you take in far more of what you *see*, than of what you read or hear. LISA works the way you do, because it portrays every action that you take *visually*.

Apple have been very clever in not giving a name to the sophisticated software which provides this function, thereby adding to the marketing concept that you are buying a LISA – not a computer and some programs. This is a refreshing change in a market that now requires a naive purchaser to specify his hardware configuration, operating system, languages and applications packages – and still has the gall to talk about 'selling solutions'.

The many journalists and dealers who have winged at LISA's projected price have completely missed the point: which is that no-one else has anything like it. It will take many months before there is serious competition, and at £7500 including hard disk, printer, twin floppies and applications software, it is very little more than a contemporary full business installation.

One thing worries me. Third party suppliers will be very keen to make their software available for LISA, and there is a very real danger that dealers (many of whom understand little about naive buyer's needs) will just end up selling it as another piece of hardware.

I have already been barraged by press releases saying that certain companies will be offering UNIX and COBOL to run on LISA. You won't be reading any publicity about that in this magazine. That is a retrogressive step – not a leap forwards.

P.S.

For those of you who still don't understand why we call our computer evaluations *'Group Car Tests'*, you'd better not read our *'Motorist's Guide to Micros'* this issue! Next month we shall be taking a serious look at three 8-bit CP/M 'saloons' and proving that they still offer great value-for-money if you just want to do word processing or Spreadsheet applications.

Richard Pawson – Editor

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THE OFFICE SUITE

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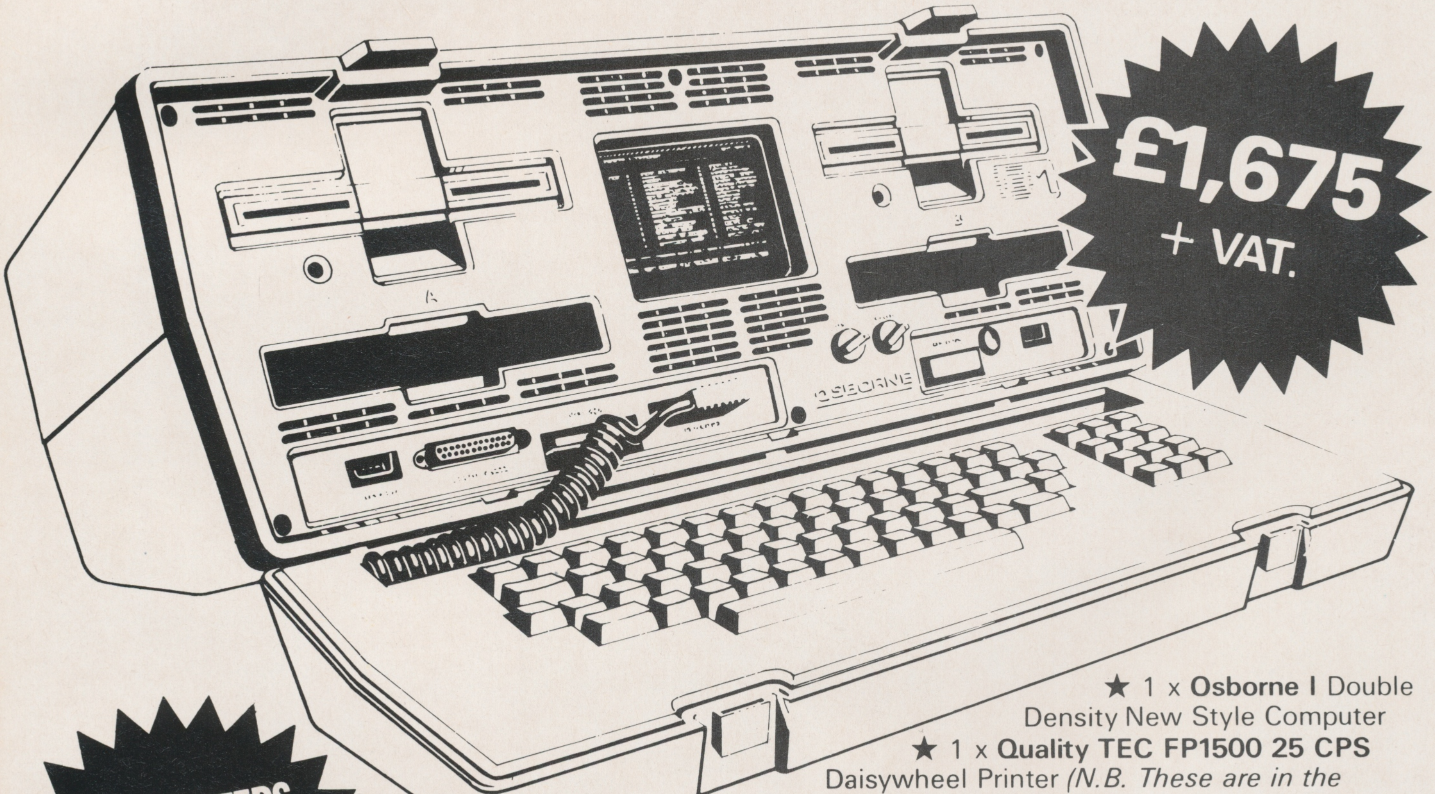

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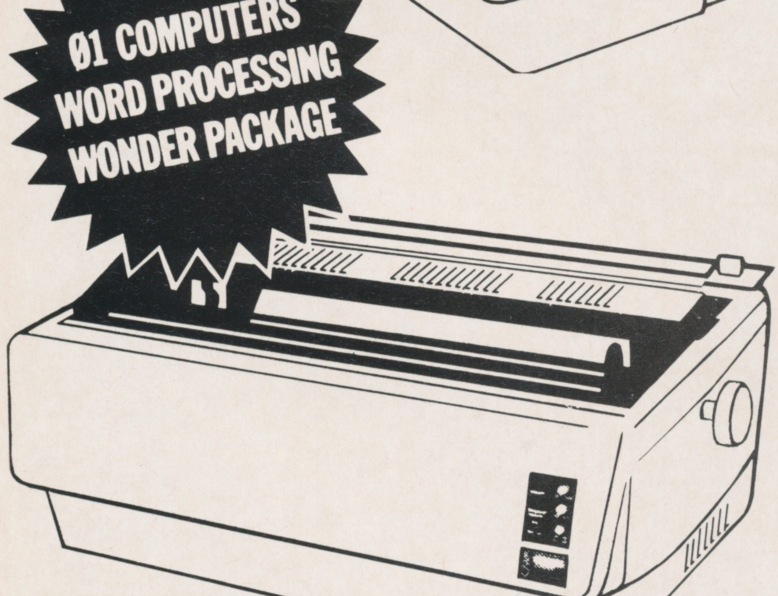

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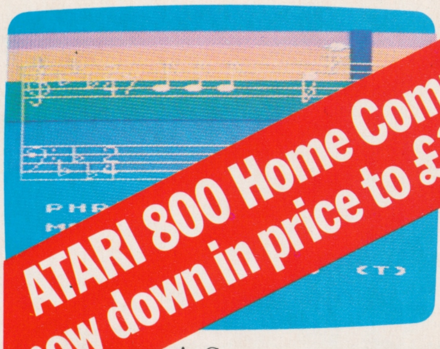
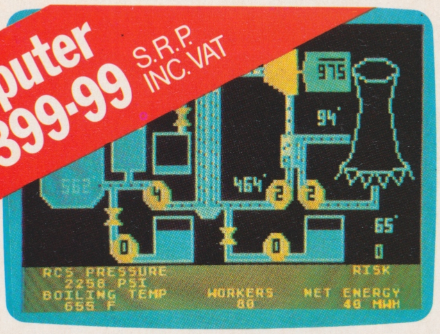


Music Composer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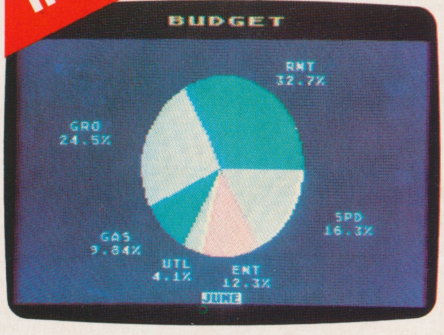
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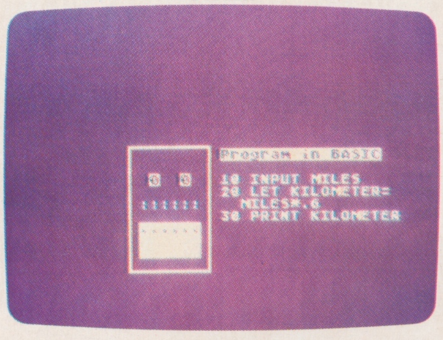
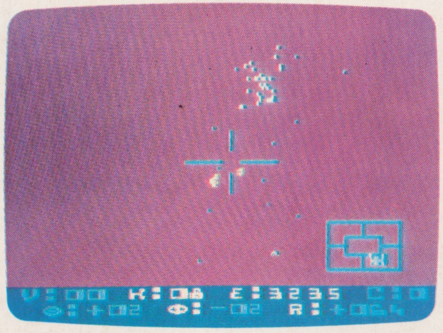

Program in BASIC
10 INPUT MILES
20 LET KILOMETER=
MILES*1.6
30 PRINT KILOMETER

Intro to BASIC 1



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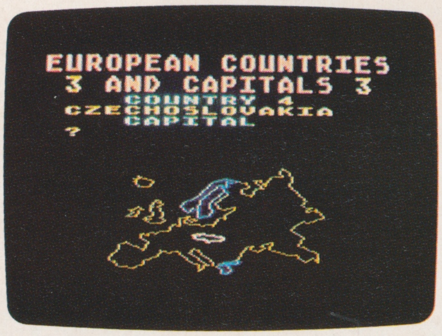
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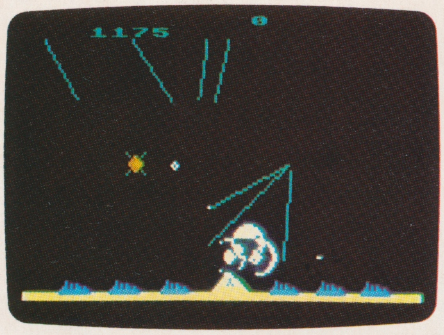

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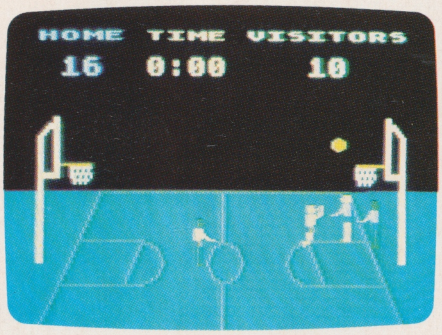
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Basketball

3.7 million reasons why the Atari Home Computer is something to see. The display screen used with our computers is composed of 192 horizontal lines, each containing 320 dots. Delivering colour and luminosity instructions to each dot for a second requires 3.7 million cycles…a lot of work for the normal 6502 processor.

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That's a quality you just don't find in ordinary home computers. And it's one of the reasons some computer experts say that Atari computers are so far ahead of their time.

There's more…which is what you'd expect from Atari Language. The Atari Home Computer uses several programming languages to give the user maximum control of its extraordinary capabilities. PILOT, Microsoft BASIC and Atari BASIC are understood and spoken by the Atari computer. You'll also find our Assembler Editor cartridge indispensable for machine language programming.

Sound. An Atari computer has four sound generators, or voices, activated by a separate microchip. This leaves the principal microprocessor chips free to perform other tasks. And you can take full advantage of this capability which is designed for easy programming.

Change. Atari Home Computers have been designed to make change and expansion easy. The Atari computer has a modular operating system that can be easily replaced as new technology develops. If you need it, memory expansion requires no more than inserting additional RAM modules.* And the Atari ROM cartridge system also makes it easy to change languages. In short, your Atari computer won't become obsolete by future developments…because it already incorporates the future.

Sharing. To learn more about the amazing capabilities of Atari Home Computers, either visit your local dealer or fill in the coupon below.

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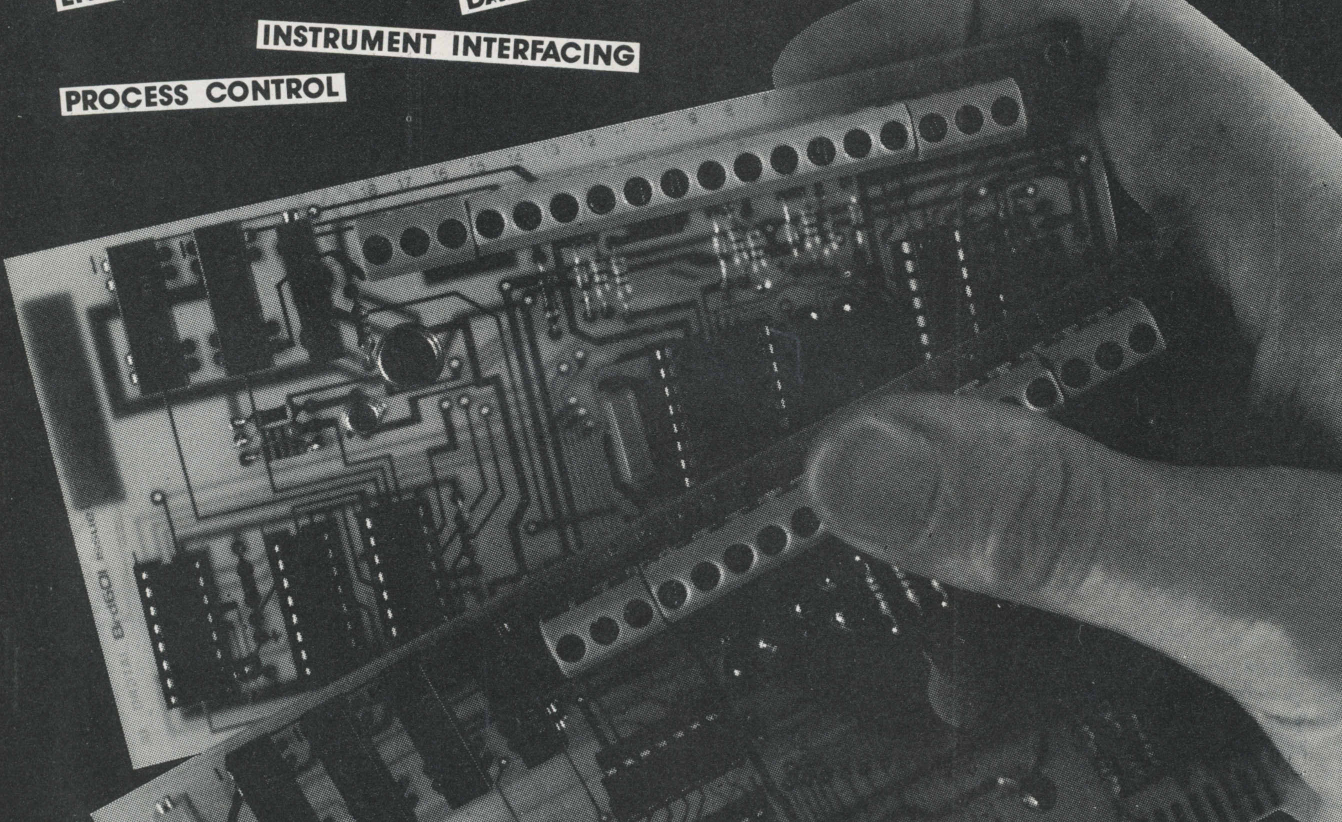

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READ/WRITE

No Laughing Matter

Dear Sir,

Don't laugh. I bought a Commodore 64.

On the 10th January 1983 I proudly took delivery of my new '64. Unfortunately the C2N cassette recorder I had also ordered was out of stock.

Only fellow greenhorns will understand the eagerness with which my son and I connected up and opened the User's Manual.

It takes time to realise that it is not oneself that is dumb, but that the User Manual like the Curate's egg, had a good shell. It would appear that the title is the only accurate thing on it. It alleges that it is a product of Commodore.

On the 15th I managed to purchase a C2N. In the course of my search for some I was much struck by the reticence of salesmen when one mentioned the '64.

On the same day my '64 retailer handed me (with a sickly grin) a list of corrections for the User's Manual. Hundreds of them under 75 headings.

After many purple hours, I concluded the C2N was a dud. On taking it back to the shop the retailer waived my suggestion that he test it and handed me another one.

Much impressed I hastened home to discover that this one wouldn't work at all!

Needless to say there is no software of any kind available. My office files sit smuggly eyeing the £400 Lump of Modern Technology.

The boy has postponed his plans and gone back to the school computer.

CONCLUSION – I still think the '64 may prove a good one.

However, when buying Commodore Products insist on a demonstration and test your purchase before handing over your cheque.

I am disappointed in Commodore. I thought such crass ineptitude was peculiar to the British.

Ivor Manning
Tilehurst
Reading

We believe the '64 will be a good one, too, Mr. Manning, but we've always stated that if you buy a newly-launched computer there will be little available in the way of software for the first few months.

The CZN is a reliable product, but as with anything from hi-fi to cameras, if you can get it tested in the shop, it could save future aggro.

Commodore's manual for the '64 bears no defence and seems to be the one thing that hasn't improved at all over their five year history of marketing computers. We're glad to hear they're working on a new one, but that still isn't any excuse.

I.T. G.I.T.

Dear Sir,

Was that photograph of a gent leaning over an ancient computer in February's *Hotline* really I.T.'s Minster, Ken Baker?

Yours sincerely,

Terrence Guinness
Black Rock
Dublin

For the benefit of our less astute readers spoof stories will now bear a small bull symbol. We print a picture of the real Kenneth Baker below.

Atrocious

Dear Sir,

Regarding the article *'Atari into Vic will go'*, p.14 March issue of your atrocious rag, the name of the company is Cardco Inc, and the Cardapter/1 as it is called is available from:

Martin Maynard, Audiogenic
34-36 Crown Street, Reading, Berks.

See p.78, Compute! Jan issue.

Yours sincerely,

J. Treacy
Archway
London

READ/WRITE

The Editor welcomes your letters, but if you require a personal reply please enclose an S.A.E.

Getting Lucky

Dear Editor,

Why is it that computers seem to be such a turn off for women?

I met a really nice girl recently and we had a great time, but then when I invited her up to inspect my Asteroids, she slapped my face.

Any suggestions as to where I could meet women who are actually *interested* in computers?

Yours sincerely,

D. Arculus
Hatton Garden
London

We think you are using the wrong software. Our good friend Paul Daniels tells us the Softporn program has been known to work, but then he is pretty fleet of finger.

Have you considered computer dating? (For our probe into this intriguing subject see the November 1981 *issue).*

Milk Monitor

Dear Sir,

I often see references to Monitors, stating how much better and clearer the screen is when using one of these with a micro computer.

As there is little standardisation between the two, would it be possible for you to do a survey on which colour monitor was compatible and which was the best? Also I seldom see many of these colour monitors for sale, only the odd advert in your magazine occasionally. So perhaps a list of suppliers and prices, also best buy. I heard there was such a TV that was dual, broadcast BBC, also colour monitor – is this true?

Yours faithfully,

F.T. Holt
Clanfield
Portsmouth

In response to your suggestion, Mr. Holt, we've commissioned a Buyer's Guide to monitors, but meanwhile here are a few tips.

To display a picture on a domestic TV, a microcomputer has to modulate its output to appear like the VHF signal coming out of your aerial socket. The TV then demodulates this for display. By using a monitor, these two processes are eliminated – along with the losses and fuzziness they induce.

There are only two types of interface to a monitor – monochrome and colour. The latter is also called RGB because it drives the Red, Green and Blue guns of the tube directly. There are, of course, different qualities – but that only really comes in when you have higher graphics resolutions than are offered on most home micros.

Most large video companies (such as Sony, National, etc) make colour monitors – including the dual standard sets you refer to. It is even possible to get multiple-standard units which can work to the US, UK and French TV standards (NTSC, PAL and SEACAM respectively). These are used both for watching pirated videos from the US and by well-known US computer manufacturers displaying 'nearly-ready' home computers at UK trade shows.

Nothing can go wrong

Dear Sir,

I have heard much talk of a 'Total Environment Control System' which would be used in a house or office to operate not only all the heating, ventilating, humidification and filtration systems but also a multitude of other functions, such as security devices.

There seems to be no limit to what could be achieved within a house if a computer could be modified in the correct way.

I would be interested to know if such a system exists, or if a modification could be made to a home computer?

If you have any advice to give on this matter I would be most grateful.

Yours sincerely,

Steve Fitzpatrick
London
NW3

Anyone who has seen the film Demon Seed *in which the lovely Julie Christie gets trapped in a computer-controlled house complete with a randy robot, is going to be less than keen on this idea, Mr. Fitzpatrick. Nevertheless, it's a subject that bears further investigation.*

There currently exists two blockages. First, is the way in which we build our houses. Quite apart from the need for some kind of Local Area Network or common bus structure, most of the household devices that could benefit from computerisation just won't interface. Then on the computer side, such a set-up would need both a sophisticated set of interfaces and an operating system to cope with multiple interruptions. Quite a few hundred pounds worth – and unless it's a multi-tasking system, you still can't play space invaders!

Which is why we've, as yet, been unable to find anyone in this country who has implemented the concept – with the exception of one or two commercially-sponsored schemes such as one by the Milton Keynes Development Corporation.

So, if any of our 50,000 readers knows anyone who has their house controlled by a micro, please let us know. So far it's a myth, but we'd like to help make it a reality.

Blue Suede Shoes

Dear Sir,

I am writing to you concerning the article in your November issue of *Micro-Computer Printout* entitled, 'The Seven Deadly Sins'.

I am rather perturbed at the final paragraph of section six, 'Den of Iniquity'. I consider the comment, I quote, "not everyone wants to look like a refugee from a gang of teddy-boys," as an insult on the tastes in footwear of individuals such as myself, who appreciate the music of the fifties. I feel that this point could have been expressed in a less derogatory manner. I trust that you will understand my feelings on this matter.

"All shook up."

Jim Henn
Lower Wick
Worcester

No offence meant, Jim. We don't mind what people wear – you should see our Art Editor!

Crazy Author

Dear Sir,

I read with interest the PET games software review in the *March edition*. However, there is an error in the index shown; namely, that Crazy-Kong is being sold by Algray of Barnsley.

I would be grateful if you would include a note in a following edition of *MicroComputer Printout* pointing out that Crazy-Kong is being sold by Supersoft of Wealdstone, Middlesex, for £9.20 (inc. VAT and p & p) and that it requires 16K of memory.

Yours sincerely,

N. Fisher
Crazy-Kong Author
London SW7 2BB

Noxious Substance

Dear Sir,

We act for NOX Chemical Corporation and our attention has been drawn to your issue dated *February 1983*. We must advise you that 'DDT' is the registered trade name of our clients, and its commercial use is restricted to products of their manufacture and those of their licencees. Any further infringement would leave our clients no alternative but to take steps to enforce their rights in this matter.

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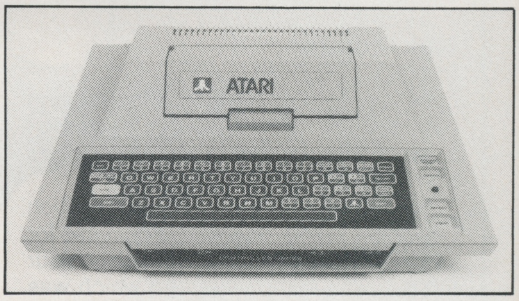

For full details ask for our hardware leaflet (XH54J) SAE appreciated

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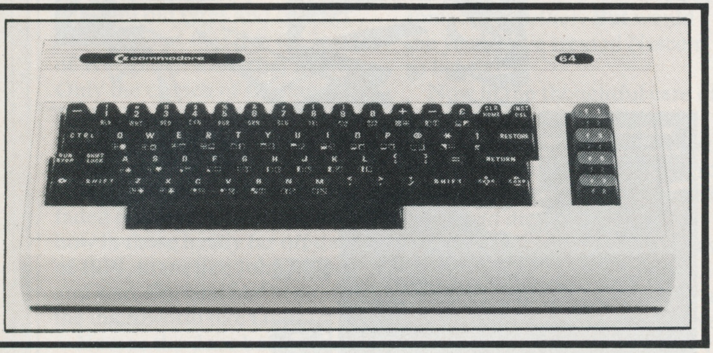

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Key: C = Cassette. D = Disk. E = Cartridge. 2C = 2 Cassettes etc. 8K, 16K shows minimum memory requirement.

Note: Order codes shown in brackets.
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Jelly Monsters Cartridge	(AC62S)	£19.95
Alien Cartridge	(AC63T)	£19.95
Super Lander Cartridge	(AC64U)	£19.95
Road Race Cartridge	(AC65V)	£19.95
Rat Race Cartridge	(AC66W)	£19.95
Blitz Cassette	(AC67X)	£4.99
Mole Attack Cartridge	(AC85G)	£24.95
Adventureland Cartridge	(AC86T)	£24.95
Pirate Cove Cartridge	(AC84F)	£24.95
Mission Impossible Cartridge	(AC87U)	£24.95
Voodoo Castle Cartridge	(AC88V)	£24.95
The Count Cartridge	(AC89W)	£24.95
Sargon 2 Chess Cartridge	(AC77J)	£24.95
Gorf Cartridge	(AC90X)	£24.95
Omega Race Cartridge	(AC91Y)	£24.95
Another VIC in The Wall Cassette	(AC78K)	£7.00
VIC Panic Cassette	(AC79L)	£7.00
Cosmiads Cassette	(AC80B)	£7.00
Backgammon Cassette (+3K)	(AC81C)	£7.00
VIC-Men Cassette	(AC82D)	£7.00
VIC Asteroids Cassette	(AC83E)	£7.00

Business Programs

Simplicalc Disk (+16K)	(AC92A)	£24.95
Simplicalc Cassette (+16K)	(AC93B)	£19.95
VIC Stock Control Cassette (+8K)	(AC94C)	£19.95
VIC File Disk (+16K)	(AC95D)	£24.95
VIC Writer Disk (+8K)	(AC96E)	£24.95
VIC Writer Cassette (+8K)	(AC97F)	£19.95

Education (CSE & GCE 'O' Level Revision)
All cassette based and require at least 8K expansion memory.

English Language	(AC98G)	£9.99
Mathematics 1	(AC99H)	£9.99
Mathematics 2	(BC00A)	£9.99
Biology	(BC01B)	£9.99
Chemistry	(BC02C)	£9.99
Physics	(BC03D)	£9.99
Computer Studies	(BC04E)	£9.99
Geography	(BC05F)	£9.99
History	(BC06G)	£9.99
Arithmetic for 9 to 11 year olds	(BC07H)	£9.99
Reading for 9 to 11 year olds	(BC08J)	£9.99
General Knowledge for 9 to 11 year olds	(BC09K)	£9.99
Spelling for 9 to 11 year olds	(BC10L)	£9.99

Home Programs
All cassette based and require at least 8K expansion memory.

Quizmaster	(BC11M)	£9.99
Know Your Own IQ	(BC12N)	£9.99
Junior IQ	(BC13P)	£9.99
Know Your Own Personality	(BC14Q)	£9.99
The Robert Carrier Family Menu Planner	(BC15R)	£9.99
VIC Money Manager	(BC16S)	£9.99
VIC Road User & Highway Code	(BC17T)	£9.99
Garden Planner	(BC18U)	£9.99
Interior Designer	(BC19V)	£9.99
BBC "Ask The Family"	(BC20W)	£9.99
BBC "Mastermind"	(BC21X)	£9.99
"Mastermind" additional General Knowledge:		
Data 1	(BC22Y)	£2.50
Data 2	(BC23A)	£2.50
Data 3	(BC24B)	£2.50
Data 4	(BC25C)	£2.50
"Mastermind" additional Specialist Knowledge:		
Wine & Food	(BC26D)	£2.50
Music	(BC27E)	£2.50
Sport & Games	(BC28F)	£2.50
Films & TV	(BC29G)	£2.50

Books About VIC

Learn Programming on the VIC	(WA31J)	£2.50
VIC Revealed	(WA32K)	£10.00
VIC Programmers Reference Guide	(WA33L)	£9.95
VIC Graphics	(WA48C)	£10.00

Lots of new VIC20 software now available.

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Danger: Networks at Work

A word in your ear, Squire, before you step on to the accelerating network bandwagon. Our advice is – don't! It is really very early days for networks, although this means of linking computers together has currently got all the manufacturers, and most of the trade, hyped up into a state in which they appear to be experiencing difficulty telling fantasy from reality.

The plain facts of the matter are that unless you are a network expert, or a dyed-in-the-wool do-it-yourself enthusiast, installing one is going to be a bitch.

This will change, of course, and given the amount of money being thrown at the problem, probably sooner rather than later. In fact, by the time networks become feasible the problem may even have become invisible, since the network will be built in to your micro. Indeed, the necessary chips are already being produced, albeit at some cost.

And that's another reason for standing back awhile: the prices are crazy right now.

What? You've got money to burn? Then let's rehearse one or two of the other snags. We'll assume, of course, that you are going to connect identical computers.

You are not? Then you'd better know that there is a whole host of gremlinary in store once you start trying to swop files between different sorts of machines. Commodore files are incompatible with Apple files, which in turn are incompatible with IBM P.C. files, and so on. The situation isn't completely desperate, as translation packages are beginning to appear. Alpha Software have, for example, developed an offering which will make IBM P.C. and Apple files compatible. It isn't on sale here yet, but you might find an American vendor willing to accept your Barclaycard by telephone. Likely cost? $195 plus postage.

The situation is slightly better with different computers using the same operating system, such as MSDOS, or perhaps CP/M. But even here you will run into snags of the hardware specific kind once you start trying to send graphics. Printer protocols are another can of worms you will be destined to explore.

If you do take our advice and wait, you are likely to see these sort of problems eased by the appearance of portable operating systems and operating environments like *VisiON*, which will run as happily on an IBM P.C. as on an Apple. It has to happen this way, since the individual microcomputer manufacturers have no incentive to develop software that could conceivably encourage you to buy other people's machines. They *want* to lock you into their systems.

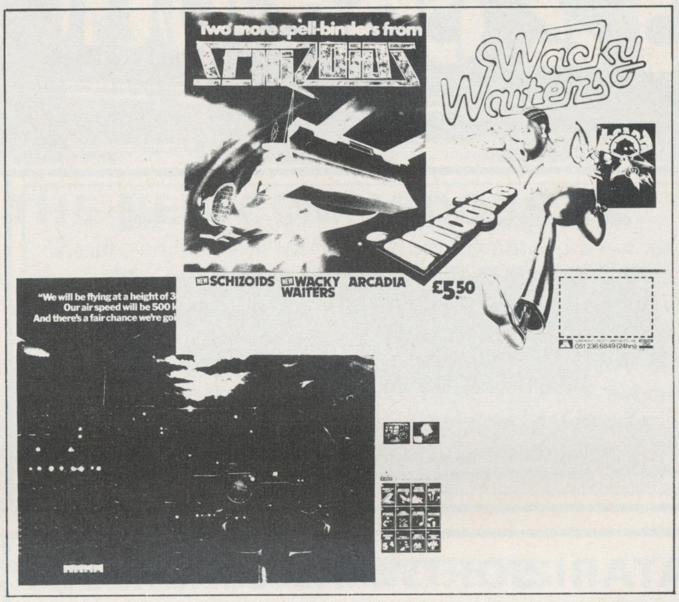
There's some indication that costs are already starting to fall, thanks to the arrival of network controllers on chips, a case in point being Intel and Fujitsu's *Ethernet* chips. *Ethernet* is in fact a standard, rather than one particular network system. But it is supported by Intel, mini-computer giant DEC, and Xerox who developed it at their Palo Alto Research Center. Our spies tell us that Hewlett-Packard and Data General will soon be joining the *Ethernet* gravy train too.

If I haven't succeeded in putting you off yet, then you should go along and talk to Dr. Tim Keen and his minions at Keen Computers, 5 Giltspur Street, London E.C.1. Get them to tell you about *Omninet*. It's slower than *Ethernet*, but a fraction of the price – and it works.

Note: For readers, and libel lawyers, with a deficient sense of humour, stories accorded the tongue-in-check treatment are flagged with a bull symbol

Julian Allason is a non-executive director of Applied Computer Techniques (Holdings) p.l.c.

Legal, Decent Honest, Incomprehensible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Let us know what you *think about computer advertising.*

Did you see these amazing ads for EMI's computer games in the January and February issue? Or the 'Whacky Waiter' ones from Imagine Software in February and March?

I dunno how much product they sold, but to look at they were marvellous. Which is more than could be said for most of the advertisements in this and other micro publications. With a few honourable exceptions, notably Sinclair and Commodore, most of them seem to be aimed at post-graduates specialising in advanced boffinry.

Presumably these ads do sell, or they wouldn't go on appearing. I mean these guys know what they're doing, right?

Anyway, I thought I'd offer one of our coveted solid sterling silver Space Invader badges (celebrated for their ability to induce attitudes of compliant attention in bank managers, and extreme grovel in head waiters; also good for unblocking drains) to the reader submitting the most incomprehensible ad from a recent issue of a micro magazine. Examples from the trade press, who appear to thrive on this sort of thing, are excluded.

Meanwhile let me leave you with the following entertaining excerpt from a Rolls Royce advertisement published in The Times on 1st February: *"A recent Owner replaced the Spirit of Ecstasy mascot on his new Rolls Royce with a silver model of a sausage. A Rolls Royce Motors spokesman stated: 'It is not the company's policy to comment on the taste of owners'."*

Wristwatch computing

Attention gadget freaks. There now follows a short update on the Great Nipponese Wristwatch Computer Race.

NEC – it stands for Nippon Electric Corporation – have just eased themselves into ther lead with a microcomputer on a chip. 'What's so new about that?' you might ask. After all, the press had been describing the microprocessor as a 'computer-on-a-chip, for years

Incorrectly, though. There is a world of difference between a C.P.U (Central Processor Unit) and a full blown computer. Which is as near as dammit what NEC have achieved with their 3S-BASIC chip. BASIC in ROM, and an LCD controller (to drive a display) are incorporated onto a single 64-pin chip. All they need now is a power source and some RAM memory. The device will sell for about £25.

Wristwatch computing, here we come.

by Julian Allason

No. 1 Nascom

In which our intrepid reporter ventures down memory lane in search of the famous micros of yesteryear.

It was a crisp winter's morning as I picked my way past the peaceful old tyres and derelict Ford Anglias that line the lanes of Wedgnoch Industrial Estate. Only the crunch of substandard ROMs under foot hinted at the glory that had once been NASCOM.

As I approached the genteely faded factory site, I reflected on how in those heady far off days of 1979, titans like John Marshall and Kerr Borland had bestridden the microworld like Gods.

Now as the door bell echoed along the cosy high tech corridors of the interior, I felt a pang of nostalgia for that golden age when life was simple and computers had but a single board.

'Age cannot wither her: nor custom stale her infinite variety' the great bard had remarked of someone or other. But would the years have treated Nascom so lightly?

Now in the thoughtful care of Lucas Logic, the old firm had begun to show flashes of its lost, youthful style, or so I had heard. But had Nascom grown old with grace and dignity?

At that moment the door was flung open by a uniformed man, holding a snarling Alsatian on a short leash. 'Push off, Shortarse. This is Saturday, and we're closed'.

E.T. Minister, Mr. Kenneth Baker (centre) meets Mr. Jack Burnett III, President of Woven Electronics, shown here (left) holding hands with his new British partner, Mr. David Parker of Eurotech Electronics. Based in two portakabins outside Andover, the joint venture is expected to arouse considerable interest in the electronics world. Readers are invited to guess the nature of the enterprise.

Shoemakers (8 letters)!

What would you say to a program 'to forecast the future behaviour of a series of numbers from its past history'?

The Editor said, "Cobblers!"

But imagine if it worked? You could use it for the pools, stock market speculation, predicting the date of the next election.

P.H. Todd M.A. (Cantab), M.Sc., mathematician, late of Dundee, claims to have produced just such a program. All the user has to do is type in the past values of the series he wishes to forecast, and tell the computer how far ahead to look.

Called FORECASTER, the program is being marketed by Microcomputer Program Design (2 Hillside Place, Newport-on-Tay, Fife, tel: 0382-645979) who are initially offering versions for the Commodore 8032 and 8096 at £320.

According to them, FORECASTER works by selecting the mathematical model that best fits the date you have given it. It then produces forecasts based on this 'best-fit' model, plus a confidence interval for that forecast. This is a range of values within which it is confident that the true value will lie 9 times out of 10, or 99 times out of 100.

Like I said – nice it if works. The Editor still thinks it is cobblers. Perhaps Mr. Todd will sue him.

Sprint plugs into anything

HP
TRS-80
XEROX
COMM
IBM
Qume

'Plug-in-and-go' – Qume's modular interface.

Qume's Sprint 11/40 Plus daisywheel printer is compatible with standard wordprocessing programs for most popular microcomputers, including such improbable stable mates as IBM, Commodore, Hewlett-Packard, Tandy and Xerox. Phew!

And all thanks to what they call their 'Modular Interface Concept'. In English that means you just plug in the appropriate interface cartridge, and you are in business.

It's such an obvious idea that it's a wonder no one thought of it before. The 40-character per second model costs £1340 with a choice of RS232-C serial, Centronics parallel and IEEE-488 interfaces. The faster 55 c.p.s. version costs £1500. Details from ISG on 0734-884666.

Electronic Male meets Golden Wonder

I'm a bit worried about the *Sunday Times*.

At this point I suppose I should make it clear that this isn't going to turn into another of those interminable dissertations on the kami kazi style negotiating procedures of its employees.

We will also pass over the colour magazine's predilection for bottoms; usually, but not exclusively, young and female, without which no S.T. fashion feature is complete. (Memo to secretary: remind me to ask Editor for more bottoms in *MicroComputer Printout* – if, as I suspect, the *Sunday Times* knows something we don't, it might help the circulation no end.)

Now, where were we?

Oh yes, the *Sunday Times*. The paper has always shown a commendable interest in hi-tech gizmos and did its duty during E.T. year by printing the required number of photographs of Mr. 'Laughing Ken' Baker, MP, PC, although they did not, so far as I know, publish a picture of his bottom.

This enthusiasm for micro matters has occasionally led the paper astray despite the valiant efforts of their distinguished hi-tech gizmo correspondent, Mr. Richard Brooks. Each week the photograph accompanying Dick the Bad's column would feature more and more keyboards. The culmination of this was a picture of the chairman of Mullard, who I take to be Mr. Arthur Mullard, whose desk groaned under the weight of some 17 keyboards, each attached to a vital piece of equipment with which he communicated, Doctor Who-style, with his empire. The gist of the accompanying article was that the electronic office would look something like this.

Could it be that Mr. Mullard, Mr. Brooks, and now five million readers of the *Sunday Times* have been misled?

The whole point, if there is a point, about the electronic office is that it is an *integrated* office. That is to say one piece of equipment can handle all the functions. So, one keyboard for computer, *Prestel* and electronic mail. Just as well, too, as I doubt the world's supply of timber could support a demand for desks large enough to support the Arthur Mullard approach to the electronic office.

Last week I saw the alternative in action. It rejoices in the name of Telecom Gold. As this is likely to become Britain's national electronic mail service, it is perhaps worth considering in some detail. In summary though, it is a system which enables you to use your own microcomputer, word processor, (or just about any device with a keyboard, microprocessor and memory) as a terminal on which electronic letters can be received or sent – in seconds rather than days, and at a fraction of the cost of the hand-delivered variety.

Each electronic letter can be flagged as 'express', in which case it goes to the top of the recipient's pile, 'reply requested', or for 'automatic acknowledgement' where this is all that's required. The same letter can be sent to as wide a circulation list as you wish.

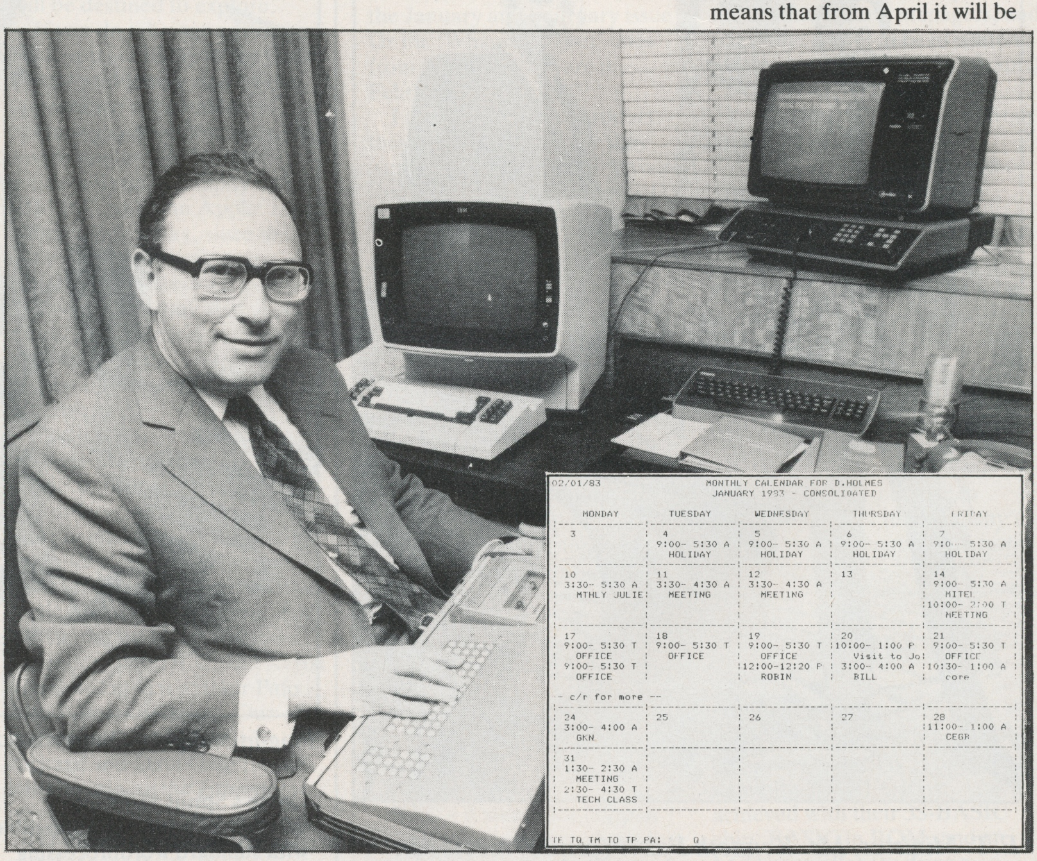
The mechanics of sending an electronic letter to another subscriber to the service are fairly straightforward. You can either prepare the letter on your computer prior to connecting to the service, this being known as off-line editing, or, if the message is likely to be a short one, you can simply dial Telecom Gold's computer and give your password to link into the system. In fact if you have an auto-dial modem, your computer can automatically do the dialling for you.

Once connected to Telecom Gold's host computer, a Prime 750 located in West London, a message appears on the screen informing you of any mail waiting. You might find that there were three urgent unread letters, five ordinary letters unread, a number you have read, but stored pending a reply, and possibly also some telephone messages. These last would have been taken by your secretary and sent to your mail box. This can in fact be quite a useful service if you are away from the office and on the move – remember that with a portable terminal like Texas Instruments' *Silent 700*, or perhaps an *Osborne*, you can access your mailbox from anywhere in Britain, or abroad come to that.

If there are a lot of messages waiting, you might choose to scan them, in which case only the names of the senders and the subject matter would be displayed, but not the contents. In this way you can pick out any that need immediate attention. The software that handles all this is really quite sophisticated, having been licensed from Dialcom who provide the service for NASA and the American Congress, as well as a number of U.S.-based corporations. I found it very easy to use, since you are prompted with the different options at each stage.

There are also some quite interesting associated services, like diary scheduling. If, for example, you wanted to arrange a meeting with two other colleagues, the software enables you to look at their diaries to see when they will all be free, or even automatically select a mutually convenient time. A database management system is also promised for later in the year.

Interworking with other British Telecom services including Telex, Telemessage (telegrams to you and I) and even Radio Paging services means that from April it will be possible to send a telex, receive a piece of electronic mail, or page an employee, all from the *same* keyboard. And that, *Sunday Times* please note, is about as close as anyone is going to get to a truly paperless office.



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02/01/83                 MONTHLY CALENDAR FOR D.HOLMES
                         JANUARY 1983 - CONSOLIDATED

    MONDAY         TUESDAY        WEDNESDAY        THURSDAY         FRIDAY
:---------------:---------------:---------------:---------------:---------------:
: 3             : 4             : 5             : 6             : 7             :
:               : 9:00- 5:30 A  : 9:00- 5:30 A  : 9:00- 5:30 A  : 9:00- 5:30 A  :
:               :   HOLIDAY     :   HOLIDAY     :   HOLIDAY     :   HOLIDAY     :
:---------------:---------------:---------------:---------------:---------------:
: 10            : 11            : 12            : 13            : 14            :
: 3:30- 5:30 A  : 3:30- 4:30 A  : 3:30- 4:30 A  :               : 9:00- 5:30 A  :
:   MTHLY JULIE :   MEETING     :   MEETING     :               :   MITEL       :
:               :               :               :               :10:00- 2:00 T  :
:               :               :               :               :   MEETING     :
:---------------:---------------:---------------:---------------:---------------:
: 17            : 18            : 19            : 20            : 21            :
: 9:00- 5:30 T  : 9:00- 5:30 T  : 9:00- 5:30 T  :10:00- 1:00 P  : 9:00- 5:30 T  :
:   OFFICE      :   OFFICE      :   OFFICE      :   Visit to Jo : OFFICE        :
: 9:00- 5:30 T  :               :12:00-12:20 P  : 3:00- 4:00 A  :10:30- 1:00 A  :
:   OFFICE      :               :   ROBIN       :   BILL        :   core        :
-- c/r for more --
:---------------:---------------:---------------:---------------:---------------:
: 24            : 25            : 26            : 27            : 28            :
: 3:00- 4:00 A  :               :               :               :11:00- 1:00 A  :
:   GKN         :               :               :               :   CEGB        :
:---------------:---------------:---------------:---------------:---------------:
: 31            :               :               :               :               :
: 1:30- 2:30 A  :               :               :               :               :
:   MEETING     :               :               :               :               :
: 2:30- 4:30 T  :               :               :               :               :
:   TECH CLASS  :               :               :               :               :
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Count the keyboards: Mr. Arthur Mullard's electronic office. Photo courtesy of the Sunday Times.

by Julian Allason

The Price of Gold

Amazingly there is no joining fee, and it is Telecom Gold's proud boast that users can be up and running within an hour. Training charges are waived, too, for the first four weeks. Thereafter courses cost £30 a head.

Telecom Gold charge 10.5p per minute's connection time between 8 a.m. and 7 p.m. Monday to Friday. At all other times a cheap rate of 3.5p a minute applies. Operating at 1200 bits per second (slower speeds are available), the system can therefore transmit about 1500 words during the course of that minute. That's the equivalent of four average business letters!

In addition, you have to pay for the telephone call. Within the London area it's just a local rate call. Subscribers further afield would have to dial into one of the twelve 'nodes' of British Telecom's Packet Switching Service. This is a data-only network which does not carry voice communications. Connection to the PSS costs £25, with £5 a quarter line rental. Calls cost 23p per 64K bytes (characters) sent plus 88p an hour duration charge.

Dialling up your Post

The procedure is very simple: first you turn on your computer. Next you dial Telecom Gold, direct if you live in the London area, or via British Telecom's Packet Switching Service (there are nodes in Birmingham, Bristol, Cambridge, Edinburgh, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Reading and Slough).

Next you listen for the carrier signal, a high pitched whistle, then press the carriage return key. At this point you must type in your subscription identity number; this can be done automatically by microcomputers equipped with audio-dial units.

Now you type in your personal password, which you can change at any time. A system identification message then appears on the screen, followed by a message notifying you of the number of read and unread express and ordinary messages.

From then on its up to you whether you read some, or all of them, scan them for anything important, or simply file them. Messages from people you don't like can even be consigned to the W.P.B. unread!

Gold-Where to Dig

Telecom Gold has its roots in British Telecom's determination to get a foothold in the burgeoning office integration market.

Following the passing of the British Telecom's Act in July 1981 consultants were despatched to investigate electronic mail systems in North America. As a result British Telecom's BT Spectrum Division entered into a joint venture with Dialcom Inc. The idea was that Dialcom would provide the technology; BT, the marketing and the cash.

Telecom Gold was launched as an independent trading company in March 1982. Since then some 120 companies have become subscribers, with 1800 individual mailboxes up on the system. These numbers are likely to increase dramatically during the next twelve months.

Until recently they were too small to cope with orders for less than 25 mailboxes, although micro consultants and academics received sympathetic treatment. Next month, however, Telecom Gold will launch a starter pack which will include membership, manual, and an instructional video tape. Microcomputer owners will be particularly welcome. Details from Telecom Gold Ltd., 42 Weston Street, London SE1 3QD. Tel: 01-403 6777.

Marketing Man in Hara-Kiri Mystery

It would be interesting to know where the idea of calling a computer *The Samurai* originated. The name refers, of course, to the Japanese warrior caste of unsurpassed ferocity, whose deeds have recently been popularised by Mr. Richard Chamberlain on the television, and Mr. Terence Wogan on the wireless.

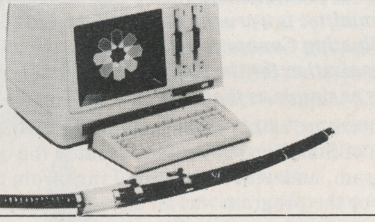
The Samurai do not, on the whole, seem to have been very tolerant people, and were prone to chopping off the heads of those who made mistakes. The *Samurai* is, however, described by its importers, Micro Networks (Tel:01-602 7405), as a user-friendly machine.

Samurai warriors were (if Mr. James Clavell's book *Shogun* is to be believed) somewhat unreliable, with a propensity for switching sides during battle. The *Samurai* computer, on the other hand, is said to be very reliable, with a Mean Time Before Failure of less than 1% for all electronic components.

Samurai were conservative to the point of reaction. The *Samurai*, with its 16-bit 8086 processor and 2.4 megabyte 8" floppies is positively progressive.

In short, this is the most half-baked marketing idea we have encountered this silly season. Honourable blockhead who thought of it please to fall on sword immediately.

Nice computer, though.



New Samurai *computer, with sword for the marketing manager to fall on.*

Literacy Korner

"But of all footmen the lowest class is literary footmen," remarked Hazlitt. The servant problem seems to have abated somewhat since 1820. The literacy problem less so, as some astounding results from our tests on Hutchinson Software's TEXT GRADER package proved. This is a readability assessment program that tells a teacher how readable a given book is. All you do is type in the text and sit back while the program applies the standard readability tests and gives the reading age on 8 different measures.

Tests performed on reading matter confiscated from the Advertising Department produced the following results:

Test Sample	**Reading Age**	**Evaluation**
Hotline	18 years	Literate, witty, occasional vocabularial excesses
Personal Computer World	116 years	Incomprehensible
Knave	2½ years	Pre-literate with pronounced mammarial bias
Letter from legal department of William Hill & Co	8 years	Simple language conveys message with extreme clarity

The TEXT GRADER program is available on disk for the *Research Machines 380Z*, and on cassette and disk for the *BBC Micro*, price £25 + VAT. Details from the lovely (and highly literate) Clare Wileman at Hutchinson Software, 17-21 Conway Street, London W1P 6JD. Tel: 01-387 2811.

Robots get Lucky

The dramatis personae of *The Super Intelligent Machine* (Cape £7.95) include Tony Benn, a post office clerk on the run from the Mafia, and an unhinged psychiatrist. The book is not a work of fiction; all of the above characters are computers.

Its author, Adrian Berry, is the Science Correspondent of the Daily Telegraph, and, judging by the credits, a keen student of this journal. Well placed, you might think, to deliver a worthy but prolix account of the evolution of the artificially intelligent.

But you would be wrong. It is thoughtful, entirely comprehensible and highly entertaining.

An indicator of the fun in store is the early appearance of the Wedgewood Benn Machine, a home brew program of Mr. Berry's own devising; prompted with a question on almost any topic the W.B.M. responds with a riposte that is scarcely less convincing than the original.

Like R.P. Abelson's earlier*Barry Goldwater Machine,* the automated Benn works by failing to answer the question. True to the originals (of all parties) the computer creates the illusion of answering by prefixing a pre-programmed spiel with a repetition of the question. Thus:

Q. *Don't you see a danger that a one-chamber government could lead to dictatorship?*

WBM *Dictatorship? That's a good question and I am glad you asked it. The answer is perfectly clear, as I have made it clear in numerous speeches. The Labour Mobilising Committee is a crucial aspect of the Labour Co-ordinating Committee which acts as an umbrella organisation for the National Constituency framework. It is as simple as that.*

Later encounters are rather more convincing. Professor Joseph Weizenbaum of Standford University created the celebrated ELIZA program, and with it a storm of rage from the psychiatric profession. For the program was an uncannily authentic simulation (some said parody) of a consultation with a Rogerian psycho-analyst.

Carl Rogers had taught that patients on the couch should always be encouraged to reveal their own fears, the analyst adopting a friendly but neutral stance. A typical consultation with ELIZA went as follows:

Hi! I'm ELIZA. What's your problem?

Men are all alike.

What way?

They are always bugging us about something or other.

Can you think of a specific example?

Well, my boyfriend made me come here.

Your boyfriend made you come here?

He says I'm depressed much of the time.

I am sorry to hear you're depressed.

etc. etc.

Berry tells the story of the patient who arrived by cab for a consultation with a real Rogerian Analyst. "Excuse me, doctor, but do you have change for a note?"

"Why don't you come inside and we will talk about it?" was the soothing reply.

So convincing was ELIZA that Weizenbaum's secretary began spending long periods with the terminal, but refused to discuss their conversations with the Professor on the grounds that they were 'too personal'.

But Artificial Intelligence is not all beer and skits. Indeed, Weizenbaum, despite his contribution to the subject, later changed his mind and became so convinced of its dangers that he argued for the banning of A.I. research.

Arthur C. Clarke seems to share this view, remarking to the author that, "The first super intelligent machine that man invents will be the last invention he is allowed to make".

Berry doubts that research into A.I. could be now stopped, believing that a ban would merely serve to push the work underground. With over a million microcomputers in private hands in this country alone, one is inclined to agree.

Opponents of Artificial Intelligence reading this book may assert the unlikelihood of machines ever mimicking human thought. But the question posed here is this: if the mimicry is sufficiently convincing, how can it be distinguishing from thought itself?

THE SUPER-INTELLIGENT MACHINE
Adrian Berry

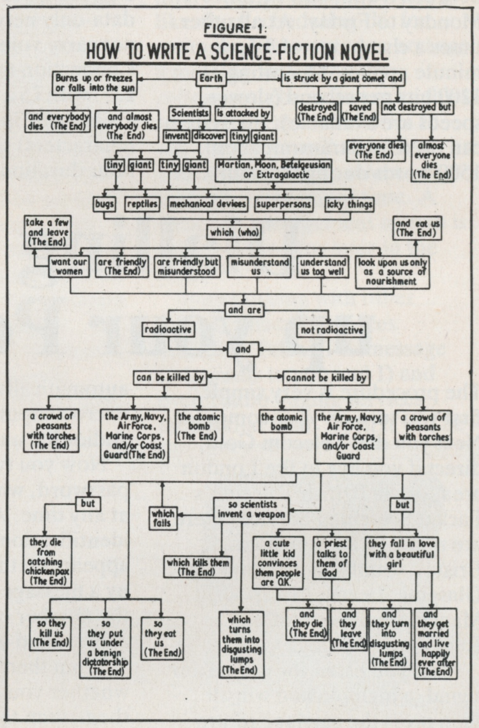


FIGURE 1:
HOW TO WRITE A SCIENCE-FICTION NOVEL
Earth
Burns up or freezes or falls into the sun
and everybody dies (The End)
and almost everybody dies (The End)
is struck by a giant comet and
destroyed (The End)
saved (The End)
not destroyed but
everyone dies (The End)
almost everyone dies (The End)
Scientists
is attacked by
invent
discover
tiny
giant
tiny
giant
tiny
giant
Martian, Moon, Betelgeusian or Extragalactic
bugs
reptiles
mechanical devices
superpersons
icky things
which (who)
take a few and leave (The End)
and eat us (The End)
want our women
are friendly (The End)
are friendly but misunderstood
misunderstand us
understand us too well
look upon us only as a source of nourishment
and are
radioactive
not radioactive
and
can be killed by
cannot be killed by
a crowd of peasants with torches (The End)
the Army, Navy, Air Force, Marine Corps, and/or Coast Guard (The End)
the atomic bomb (The End)
the atomic bomb
the Army, Navy, Air Force, Marine Corps, and/or Coast Guard
a crowd of peasants with torches
but
which fails
so scientists invent a weapon
but
they die from catching chickenpox (The End)
which kills them (The End)
a cute little kid convinces them people are O.K.
a priest talks to them of God
they fall in love with a beautiful girl
so they kill us (The End)
so they put us under a benign dictatorship (The End)
so they eat us (The End)
which turns them into disgusting lumps (The End)
and they die (The End)
and they leave (The End)
and they turn into disgusting lumps (The End)
and they get married and live happily ever after (The End)

The Berry approach to flow-charting

What, for example, is one to make of Professor Colby's PARRY program, which thinks it is pursued by the Mafia? The machine gives every appearance of believing that it *is* Frank Smith, bachelor Post Office clerk in hourly danger of assault, that the police are criminally negligent in not taking his fears seriously, and that people who speak to him may be in league with one or other organisation. The mere mention of 'Italians' is enough to spark him/it off…

It was probably inevitable that someone should seek to introduce PARRY to ELIZA. Needless to say the meeting was a disaster. As Berry drily observes: "These two artificial personalities, one of whom is an eccentric psychiatrist and the other an hysterical petty criminal, are not in themselves very convincing advertisements for the prospects of machine intelligence."

Quite so. The late Christopher Evans in his book, the *Mighty Micro*, estimated that the intelligence of the world's most powerful computer was the equivalent of an earwig on the human scale. That was in 1978.

Berry has ingeniously computed the comparison in terms of memory. Against the 32,000 bytes of a typical personal computer, the human brain sports some 100,000,000,000 nerve centres, making it some 12,000 times more powerful than the world's most powerful computer.

On the other hand, the Japanese Ministry of Trade and Industry has put $430m into the construction of a SuperComputer, (that money to be triple-matched by Japanese industry), which is to be as intelligent as a human being.

Hmmm!

by Julian Allason

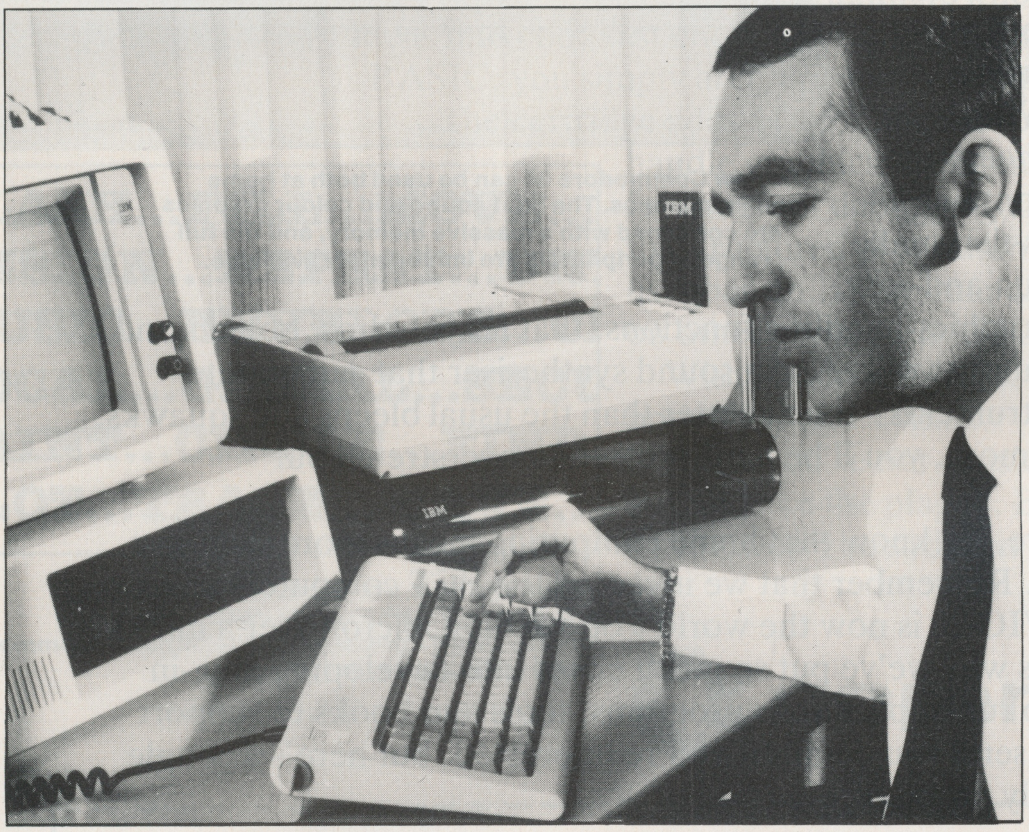
Dog fails to bark in the night

The daily pile of duns, threatening letters and lying press releases contains a novelty this morning: a complaint from a lady reader. Miss Roberta Gleadow, who kindly encloses a photograph of herself in a bathing costume (more *out of* than in, actually), is indignant that the launch of IBM's Personal Computer was not covered on these pages.

The explanation is simple enough, Roberta. These are *supposed* to be news pages, although we will admit, if pressed, to the odd excursion into faction. Your correspondent has been boring everyone rigid about the *P.C.* ever since that buccaneering band of low-lifers began grey importing it eighteen months ago.

In our jaundiced view IBM's announcement amounted not to a *launch*, but merely the amendment of an existing distribution arrangement. Apart from the addition of '£' key, our crack team of trench-coated 'tecs was unable to discover any difference between the 'new' *P.C.* and the old one – which *is* beginning to look just the teensiest bit grey around the temples, compared to thrusting young newcomers like Tycom.

Perhaps we could discuss it over dinner, one evening, Roberta?

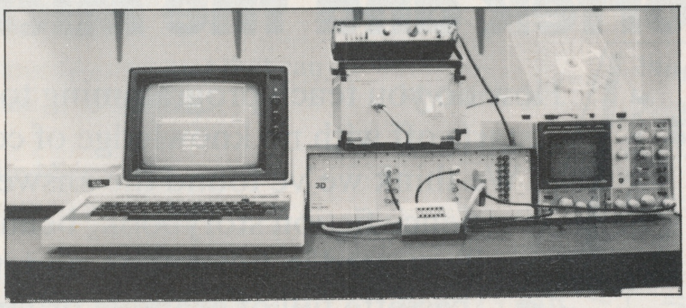


IBM's 'new' P.C. – spot the difference. We couldn't.

3D BBC

Over a jolly lunch (OK, OK but it is how I earn my living) with Acorn's Chris Curry, a '75 to 80% share of the educational market' was claimed for their BBC Micro. Nice going, although I don't suppose the previous title holders, Research Machines, would necessarily agree.

Why the BBC machine remains relatively unsuccessful in industrial markets had always been a bit of a mystery to me, until I ran into Kahtan Kibasi of 3D. "No built-in interface" he explained with the sort of inscrutably confident grin favoured by conjurors and students of the Harold Wilson School of Method Acting.



Industrial interfaces for the BBC micro.

Testing, control and monitoring are subjects close to Dr. K's Iraqui heart, so it wasn't a total surprise when he whipped the covers off his latest INLAB modular interface. Commodore, Apple, Sharp and Sirius are all supported, and now the BBC Micro. Chris Curry will be pleased.

And so should anyone else whose interests lie in this direction. The cards cost between £100 and £500 from Digital Design & Development at 18/19 Warren Street, London W1P 5DB. Tel: 01-387 7388.

P.S. In case you were wondering, I bought the drinks.

Up Periscope

One of the best reasons – some say it is the only one – for reading *Newsweek* is a feature called 'Periscope'. In it the magazine's four and a half thousand brylcreamed hacks attempt to predict future news stories. Ever ready to flog a good idea to death when we see one, this column proposes to plagiarize it with some wildly inaccurate guessing about micros that may, or may not, be in the pipeline.

One that isn't, unless you happen to live in the Land of the Rising Sony, is Commodore's *Max*. King Kong has, however, been showing his friend(s) a handheld dubbed the HHC-4. This has 4K of RAM, expandable to 16K, calculator-type QWERTY keyboard and a 24-character Liquid Crystal Display. Sundry enchancements of the excellent *Commodore 64* are also in train.

Sinclair boffins are also hard at work on a new computer. "Will it be a business system?" I asked Uncle Clive. "It will be *suitable* for business use," was his carefully considered reply. Expect a typewriter keyboard, 16-bit processor, lots of RAM, and the celebrated (but currently invisible) microfloppies, probably built-in.

Having astonished the world with the daringly high price of *LISA*, Apple now hope to astound it with a daringly low one for *Macintosh*. Heed not anyone who tells you it is a low-cost *LISA* though; it isn't, although a high degree of user-friendliness is a common feature.

With a public stock offering scheduled, Osborne would have liked to keep the lid on their new range. The underwriters think differently and want more details, pending which the flotation has been postponed. My guess (nudge, nudge, wink, wink!) is that Master Adam will have to show them the IBM P.C. – compatible portable with half-height 5-1/4" floppy disk drives he keeps hidden under his bed.

But for my money, the year's most interesting micro innovation will be announced by a British firm, of which more next month…

PROGRAMMING

The new Commodore 64 can be used both at home and in business. The best sound and colour graphics are combined with a massive memory, and the full range of peripherals are immediately available.

If you're thinking of buying a home computer, then you'll probably also be interested in learning to program. If so then the new Commodore 64 is the ideal machine – at just £299.*

Because quite apart from the vast range of off-the-shelf programs we can supply (unlike other home computers, the Commodore 64 can run a small business with Word Processing, Spreadsheets and Database), the '64 contains a whole list of features that make programming both fun and easy.

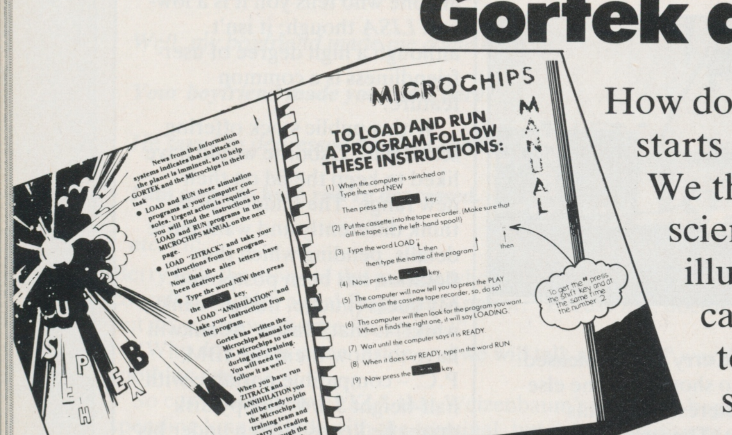
Like our unique graphics-handling functions, that let you draw objects and then move them around at will. And a sound synthesiser that can imitate different musical instruments – much better than the usual bleeps and squawks. And with 64K of memory, you'll be hard pressed to overstretch our computer!

But at Commodore, we know that home computing means more than just clever specifications. Remember that we invented the PET computer over six years ago, and our VIC-20 is now the world's best selling micro (over a million to be precise). That's why we've put so much effort into developing plug-in peripherals, ready to run applications programs, tools and books to support the '64. We'll gladly send you details if you're interested, but here's a couple that we're particularly proud of:-

Gortek and the Microchips

How do you teach programming to someone who starts off with no knowledge of computers at all? We think we've found the answer – it's a sort of science fiction storybook, beautifully illustrated in full colour, and it comes with a cassette full of example programs referred to in the text. It costs just £12.95; we were so impressed that we commissioned a version for our VIC-20, too.

Funny thing is: though we wrote it for kids, it seems to appeal just as much to adults!



News from the information systems indicates that an attack on the planet is imminent, so to help GORTEK and the Microchips in their task

- LOAD and RUN these simulation programs at your computer consoles. Urgent action is required—you will find the instructions to LOAD and RUN programs in the MICROCHIPS MANUAL on the next page.
- LOAD "ZITRACK" and take your instructions from the program.

Now that the alien letters have been destroyed

- Type the word NEW then press the key.
- LOAD "ANNIHILATION" and take your instructions from the program.

Gortek has written the Microchips Manual for his Microchips to use during their training. You will need to follow it as well.

When you have run ZITRACK and ANNIHILATION you will be ready to join the Microchips training team and carry on reading through the book.

MICROCHIPS MANUAL

TO LOAD AND RUN A PROGRAM FOLLOW THESE INSTRUCTIONS:

(1) When the computer is switched on Type the word NEW
Then press the key.
(2) Put the cassette into the tape recorder. (Make sure that all the tape is on the left-hand spool!)
(3) Type the word LOAD " then then type the name of the program then "
(4) Now press the key.
(5) The computer will now tell you to press the PLAY button on the cassette tape recorder, so, do so!
(6) The computer will then look for the program you want. When it finds the right one, it will say LOADING.
(7) Wait until the computer says it is READY.
(8) When it does say READY, type in the word RUN.
(9) Now press the key.

To get the " press the Shift key and at the same time the number 2

Gortek and the Microchips is a new concept in teaching programming to beginners. The storybook and worked examples appeal to both kids and adults.

MADE EASY!

Simon's BASIC

This is for people at the other end of the scale: experienced home programmers who just can't get their creativ ideas into code fast enough! Frankly, without a '64 and Simon's BASIC, you simply aren't properly equipped. Here's why.

The cartridge adds 114 commands to BASIC. Commands that handle graphics, Commands for music, Commands for program debugging and security, Commands for structured programming and mathematics, the list goes on....Commands that you just don't find on other people's BASICs. And all for £50.

With Simon's BASIC, programming becomes both a joy and a cinch.

But if you're not considering a '64, avoid Simon' BASIC like the plague. Because once you've used it, you won't be satisfied with anything less.

LASH...FILL...MOVE...
ESIGN...REPEAT...UN
USIC...ENVELOPE...C
OCAL...GLOBAL...SECU
AINT...CIRCLE...FIND
LOT...TRACE...WAVE...

These are just some of the 114 English-like commands which Simon's BASIC adds to the Commodore 64, each one replacing whole sections of conventional code.

commodore

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[ ] The Commodore 64 computer that can be used at home or in business.

[ ] Gortek and the Microchips – for newcomers to programming.

[ ] Simon's BASIC – the programmer's dream come true!

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The name of this program is PAYROLL 2 and it runs on the Commodore CBM 8000 and 700 computers.

We won't tell you more about it here, other than to say, it would make very great sense to ensure you see a demonstration of this remarkable program before purchasing a payroll package. It would be highly frustrating to purchase another and then become aware of the PAYROLL 2 excellence afterwards.

*** Yes - it will assist with the dreaded SSP ! ***

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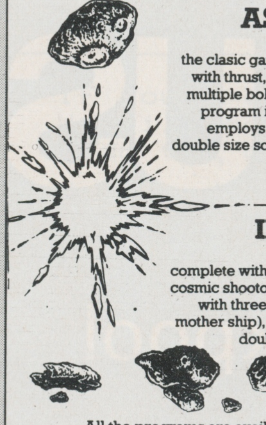
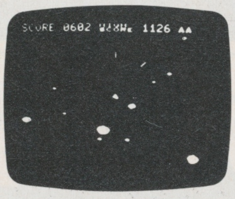
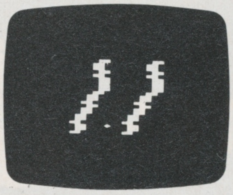


ASTEROIDS

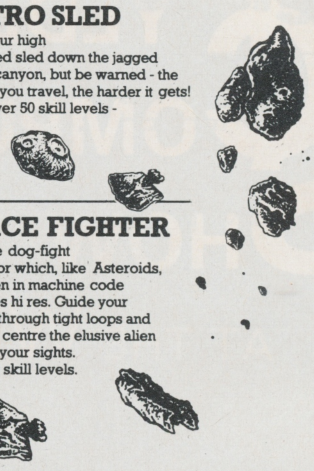
A classic version of the clasic game. Feature packed with thrust, hyperspace, rotate, multiple bolts, etc. This exciting program is written in m/c and employs hi-res graphics and double size screen techniques for maximum effect.





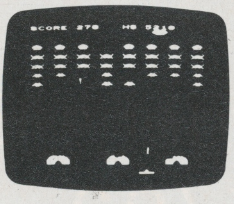
ASTRO SLED

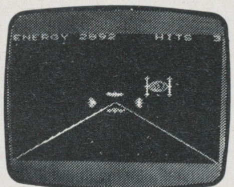
Pilot your high powered sled down the jagged space canyon, but be warned - the further you travel, the harder it gets! With over 50 skill levels -



INVADERS

No machine is complete without this, the original cosmic shootout. In machine code with three invader types (plus mother ship), bonus bases, hi-res, double size screen, etc.

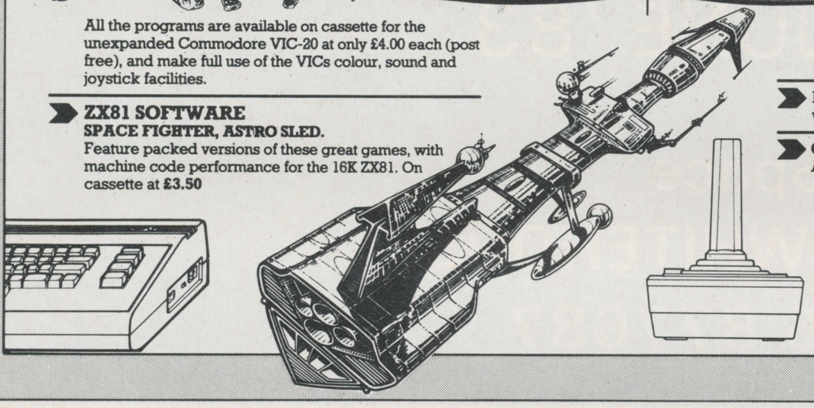




SPACE FIGHTER

A space dog-fight simulator which, like Asteroids, is written in machine code and uses hi res. Guide your fighter through tight loops and turns to centre the elusive alien craft in your sights. With 10 skill levels.

All the programs are available on cassette for the unexpanded Commodore VIC-20 at only £4.00 each (post free), and make full use of the VICs colour, sound and joystick facilities.



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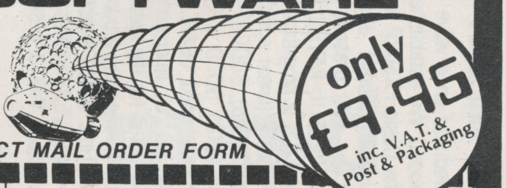
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C.B.M. 8000 series — Disk only — Price £24.00.
All other versions — Price £18.00, Tape — £19.50 Disk — inc P&P and V.A.T.

N.B This program will not run on the VIC.

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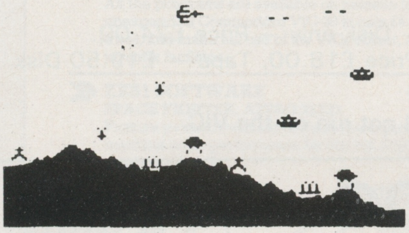

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A MACHINE CODE ARCADE QUALITY GAME

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8. COSMIC RAIDER
9. FOUR THOUGHT . . .

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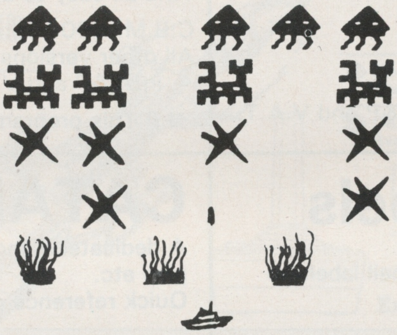

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For the unexpanded Vic20

The Vic Multisound Synthesiser is very flexible and can be played in more ways than can ever be explained here, to create music and special effects. For example, create any tune, up to 255 notes (after following appropriate instructions), then press "F1" or "F3", then key "9" and enjoy the added effect. Now hit "+", listen to the difference. For a surprise — hit "−". Now add a melody over the top — hit key "8" then "7" — now play a melody, or experiment. *Have fun!*

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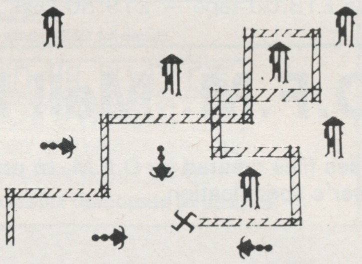
SHARK ATTACK

For unexpanded Vic20

You are in shark-infested waters after being thrown overboard from a pirate ship. Your only protection being an atomic net which you trail behind you, trying to cover all the visible ocean and ensnare the sharks at the same time. Beware of stopping or covering your tracks for too long, if you do, then the sharks will escape and come after you. Watch out for the ever increasing deadly octopi (somtimes the sharks will eat part or all of one!)



"A real action shot of the game"

NEW NEW NEW

SPACE ATTACK

For the unexpanded Vic20

SPACE ATTACK is a game of skill. You as the pilot of an intergalactic battleship have to fight your way through wave after wave of various alien spaceships.

MACHINE CODE ARCADE QUALITY GAME

SPACE FORTRESS

For the unexpanded VIC 20

A machine code, arcade quality game. Brilliant action, beautiful graphics and absolutely amazing sound effects. You are attacked by four different types of aliens, each type of alien coming in waves. Once you have destroyed all the aliens a fortress appears — this you have to destroy before it disappears into hyperspace.

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TOP TEN

GAMES SUPPLIERS

ROMIK SOFTWARE
MARTIAN RAIDER
MOONS OF JUPITER
MIND TWISTERS
SUPER NINE
ZX 81
GREAT NEW DEALS FROM MICRO POWER
IF THE CLOUDHOPPERS WASPS, SPIDERS, METEORS OR SATELLITES DON'T BEAT YOU... RENAISSANCE WILL
CLOUDBURST
meteor run
Renaissance
Spiders of Mars
satellites and meteorites
5 More great VIC Cartridge games from Audiogenic

With so many suppliers and manufacturers now advertising computer products, it can be very difficult for the newcomer to get a 'feel' for the market place. In the first of a series of Buyer's Guides, *Charles Christian* gives a thumbnail sketch of ten top games suppliers and what they do. Next month he will be looking at printers.

Just over a century ago the poet, Alfred, Lord Tennyson, first penned what have now become those immortal words 'in spring a young man's fancy lightly turns to thoughts of love'.

Nowadays it is not only love that young men – and women – lightly turn their fancies to. With bank accounts once more taking on a healthy sheen after recovering from the ravages of Yuletide extravagances, and with pay-packets blooming thanks to the latest munificences of a vote-hunting Chancellor of the Exchequer, spring is also the time when many people start seriously considering just what to buy next.

New cars, stereos, clothes, videos and, more recently, new computer kit, are all items that start appearing on people's shopping lists about this time of year. Of course if you already know something about the type of item which you are considering buying, then making your final choice as to the particular model you actually opt for should not cause you any real problem.

But what happens when you are a complete stranger to the product market into which you are moving?

True, there are plenty of magazines of the 'Who/What/Which Thing' variety on any bookstall and there are also ample newspapers carrying advertisements for rival products. But if you are not careful this surfeit of information can actually confuse rather than educate the newcomer.

In an attempt to try to overcome this problem – at least as far as computers and computer related products are concerned – this month *MicroComputer Printout* is starting a new series for first-time buyers.

Called *The Top Ten*, its aim will be to give potential purchasers a brief introduction to the leading companies and their products in various different sectors of the computer market. In otherwords, to put a bit of flesh onto the bare bones of the suppliers you may either have read about in magazines or heard about in stores.

For this reason, as well as talking about purely technical matters, like hardware and software, we will also be looking at suppliers from more of a *human interest* angle, considering such things as their corporate background, the leading personalities in the business and even their philosophy. The end result – we hope – is that the newcomers will have a supply of basic at-a-glance information that gives a good indication of what is available, where they can get it from and just who they are going to be dealing with.

Two points however to remember from the very outset:

Firstly, our *Top Ten* charts have not been compiled as the result of a scientific analysis of objective data – such as turnover, profits or unit sales. Our criterion has been *market presence*. In other words, the ten leading suppliers which newcomers are most likely to have encountered whether by word-of-mouth, reputation, advertising coverage, press exposure or simply because there are more of their products in the local stores than those of anyone else!

Secondly, and following logically on from this, our *Top Ten* charts are not drawn up in any form of preference, merely alphabetical order.

Two further points should also be borne in mind:

(a). Any indication of size is to some extent misleading, as most of this Top Ten only directly employ a few people on a full time basis – usually in their distribution facilities. In addition to the numbers shown nearly all of them also use the services of freelance programmers and sub-contract out manufacturing and tape duplication work to other organisations. Thus they are often far larger business concerns than might at first be apparent on paper.

(b). No reference has been made to price as game costs are subject to a number of variables including: the complexity of the game and the medium it is recorded on, as well as individual distributors changing pricing policies. As a rule of thumb most of the games currently available on the UK market are encompassed in the £5 to £35 price bracket.

As to the subject matter of our charts, in the months to come we will be looking at such topics as the major wordprocessing packages, the leading printer manufacturers and the main business software houses – to name just a few.

This month, however, we are starting off on a relatively light note with *The Top Ten Computer Games Suppliers*.

Now read on ....

TOP TEN GAMES SUPPLIERS

1 COMPANY NAME	AUDIOGENIC	BUGBYTE	IMAGINE SOFTWARE
2 ADDRESS FOR CUSTOMER ENQUIRIES	P.O. Box 88 Reading, Berkshire Tel: (0734) 586334	100 The Albany Old Hall Street Liverpool L3 9EP Tel: (051) 227 2642	Masons Building Exchange Street East Liverpool L2 3PN Tel: (051) 236 6849
3 TITLE OF CURRENT BEST-SELLING GAME/S	Alien Blitz Spiders of Mars Grand Master Chess	Spectrum Invaders	Arcadia
4 RECORDING MEDIA	Cassette Cartridge Disk	Cassette	Cassette
5 HARDWARE CATERED FOR NOW	**ATARI** 400/800 **COMMODORE** PET/ VIC 20/64 **DRAGON** 32 **SINCLAIR** ZX Spectrum	**BBC MICRO** **ORIC**-1 **SINCLAIR** ZX81/ Spectrum	**COMMODORE** Vic-20 **SINCLAIR** ZX Spectrum
6 AND PLANNED FOR THE FUTURE			
7 WHERE DO THE PROGRAMS COME FROM AND WHO WRITES THEM	In-house programmers + represents 2 U.S. software houses 'Creative Software' and 'United Microware Industries' under licence.	In-house programmers + sub-contract to freelance programmers.	In-house programmers
8 WHAT IS THE COMPANY'S DISTRIBUTION POLICY	Primarily via dealers both in UK and Europe.	Now primarily via dealers	Via dealers and mail order
9 BACKGROUND	Originally started in 1973 providing recording facilities for audio industry. Now employs staff of 23 and under direction of Martin Maynard has moved into computer games market.	Formed in 1980 by partners Tony Milner and Tony Baden. Now employs 10 full-time staff.	Formed by partners Mark Butler and Dave Lawson in 1981. Currently employ 9 full-time staff.
10 COMPANY PHILOSOPHY	"To be marketing orientated, to provide a good distribution network and to sell products based on sound consumer/dealer research rather than gimmicks."	"To provide high quality arcade games and adventures."	"To produce playable, addictive games that will appeal to and provide entertainment for everyone.

TOP TEN GAMES SUPPLIERS

MICRODEAL	**MICROPOWER**	**QUICKSILVA**	**RABBIT SOFTWARE**
41 Truro Road St. Austell Cornwall (new address) Tel: (0726) 67676	8/8A Regent Street, Chapel Allerton Leeds. LS7 4PE Tel: (0532) 683186	92 Northan Road Southampton Tel: (0703) 20169	308 Station Road Harrow Middlesex HA1 2DG Tel: 01-863 0833
Scarfman Planet Invader	Swoop Alien Destroyers Chess	Timegate Meteor Storm	Scramble Myriad
Cassette and Disk	Cassette	Cassette	Cassette
DRAGON 32 **TANDY** TRS-80 I/III/ Colour **VIDEO GENIE** I/II/III	**ACORN** Atom **BBC MICRO** (predominantly) **NASCOM** **SINCLAIR** ZX Spectrum (Expanded Version)	**BBC MICRO** **SINCLAIR** ZX81/ Spectrum	**COMMODORE** Vic-20/ '64
	DRAGON 32	"All popular micros"	Looking at a number of popular micros.
Primarily under licence from U.S. software houses + independent programmers on a royalty basis (and looking to recruit more).	In-house programmers + independent programmers on a royalty basis (and looking to recruit more).	In-house programmers + independent programmers on royalty basis (and looking to recruit more).	In-house programmers + represents US software houses under licence.
Via dealers and mail order.	Primarily via mail order + now expanding dealer base.	Via dealers including High Street chain stores + mail order + overseas.	Primarily via dealers including High Street chain + overseas.
Formed in 1980 by Managing Director John Symes, now employs 8 full-time staff.	Formed at the end of 1979 by Bob Simpson as a division of existing hardware dealership. Currently employs 14 staff.	Founded by games enthusiast Nick Lambert in 1980. Now employs 6 full-time staff.	Started in 1981 as subsidiary of hardware company by Alan Savage. Has expanded since then and now employs 12 full-time staff.
"To offer only the best games available for the hardware range catered for."	"To be the best in the business, but also to recognise that the computer comes first and that customer liaison and back-up is a vital factor."	"To become an electronic publishing house regularly producing new games written by established software authors."	"To produce the best possible games for the best possible machines on the market."

▷

TOP TEN GAMES SUPPLIERS

1 COMPANY NAME	**ROMIK SOFTWARE**	**SOFTWARE FOR ALL**	**THORN EMI VIDEO**
2 ADDRESS FOR CUSTOMER ENQUIRIES	24 Church Street Slough Berkshire. SL1 1PT Tel: (0753) 71535	Dept CV, 72 North Street, Romford, Essex Tel: (0708) 60725	Thorn EMI House Upper St. Martin's Lane London. WC2H 9ED. Tel: 01-836 2444.
3 TITLE OF CURRENT BEST-SELLING GAME/S	Martian Raider Moons of Jupiter Strategic Command	The Frog	Submarine Commander Jumbo Jet Pilot
4 RECORDING MEDIA	Cassette	Cassette	Mainly cartridge
5 HARDWARE CATERED FOR NOW	**COMMODORE** Vic-20 **DRAGON** 32 **SINCLAIR** ZX81	**BBC MICRO** **DRAGON** 32	**ATARI** 400/800 **COMMODORE** Vic-20
6 AND PLANNED FOR THE FUTURE	**ATARI** 400/800 **BBC MICRO** **COMMODORE** 64 **SINCLAIR** ZX Spectrum	**SINCLAIR** ZX Spectrum	**TEXAS INSTRUMENTS** TI 99/4A
7 WHERE DO THE PROGRAMS COME FROM AND WHO WRITES THEM	In-house + subcontract programmers (and looking to recruit more programmers).	In-house programmers + independent programmers on a royalty basis.	In-house programmers.
8 WHAT IS THE COMPANY'S DISTRIBUTION POLICY	Via dealers both in UK + overseas.	Primarily via mail order + now expanding dealer base.	Via dealers including High Street chain stores.
9 BACKGROUND	Formed by games enthusiast Mike Barton in 1982. Now employs 27 staff.	Started up by the Weinrich's – a husband and wife team – in 1980. Business has diversified and now has 4 full-time staff on the games side under the supervision of Mrs. M.S. Weinrich.	Formed in 1982 as a new division of the giant Thorn-EMI group. Current UK Marketing Director Mike Dixon.
10 COMPANY PHILOSOPHY	"To provide the games addict with a regular supply of new high quality games."	"To provide state-of-the-art games offering good graphics and value for money."	"To provide the thinking mans approach to video games that do not rely solely on hand-to-eye co-ordination.

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Calcstar (CP/M) (80 column sprad sheet)	59.00	**67.85**
dBase II (CP/M)	325.00	**373.75**
Data Star (CP/M) (powerful data entry)	122.00	**140.30**
Data Perfect	67.00	**77.05**
D.B. Master (version 3.02)	102.95	**118.39**
D.B. Master statistics	47.95	**55.14**
D.B. Master utilities (links with visi's)	47.95	**47.95**
Desk Top Plan II	110.00	**126.50**
Dutil (for dBase II)	61.00	**71.15**
Graphmagic (bar graphs, pie charts, etc)	52.00	**59.80**
Mathemagic	52.00	**59.80**
Msort-80 (stand alone CP/M sort)	125.00	**143.75**
Multiplan (Microsofts superior spreadsheet)	155.00	**178.25**
PFS Filing system	59.00	**67.85**
PFS Graph	59.00	**67.85**
PFS Report	47.00	**54.05**
Quick Code (for dBase II)	189.00	**217.35**
Supersort (CP/M)	85.00	**97.75**
Supercalc (CP/M Spreadsheet)	115.00	**132.25**
The General manager	68.00	**78.20**
The Last One (programme generator)	260.00	**299.00**
Versaform (form generator in Pascal)	192.00	**220.80**
Visicalc	122.00	**140.30**
Visi + (visicalc consolidation)	19.45	**22.37**
Visicalc utilities	34.00	**39.10**
Visidex	135.0	**155.25**
Visiplot	99.00	**113.85**
Visitrend/plot	155.00	**178.25**

WORD PROCESSING		
Applewriter II	72.00	**82.80**
Executive Secretary	145.00	**166.75**
Executive Speller	45.00	**51.75**
Format 80	195.00	**224.25**
List Handler (Mailer & Form Letter)	63.00	**72.45**
Magic Mailer	45.00	**51.75**
Pie Writer (40/80 columns)	85.00	**97.75**
Sensible Speller (new fast proof reader)	69.00	**79.35**
Screenwriter II (70 col w/out 80 col card)	75.00	**86.26**
Super Text 4080	109.00	**125.35**
Wordstar 3.01 (CP/M) (enhanced features)	135.00	**155.25**
Word Handler (does not req. 80 col. card)	99.00	**113.85**
Zardax (40/80 & inc form letter)	125.00	**143.75**

PRINTERS		
Epson MX80T-3 (up to 132 col & hi-res)	305.00	**350.75**
Epson MX80FT-3 (as above & friction drive)	339.00	**389.85**
Epson MX82FT (Very hi-res graphics)	359.00	**412.85**
Epson MX100FT-3 (100 cps & wide carriage)	429.00	**493.35**
Mannesmann Tally MT120I (160 cps)	365.00	**419.75**
Nec 8023 (100 cps & Prop. spacing)	339.00	**389.85**
Silentype & interface	159.00	**182.85**
Smith Corona TP-I (daisy wheel printer)	449.00	**516.35**
Tec 1500-25 (25cps daisy wheel)	525.00	**603.75**

PRINTER INTERFACE CARDS		
Aristocard Parallel	69.00	**79.35**
Aristocard Serial	75.00	**86.25**
CPS Multifunction Card (inc real time clock)	119.00	**136.85**
Digitek Printmaster (BASIC/CPM/PASCAL)	69.00	**79.35**
Digitek Printmaster III with memory mang	159.00	**182.85**
Grappler + (Epson/Anadex/Cent/Nec)	95.00	**109.25**
IPB-16K (serial/parallel card & buffer)	125.00	**143.75**
MBP-16K (Epson 16K buffer)	96.00	**110.40**
Wizard 16K Buffer & graphics interface	143.00	**164.45**

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Softswitch (for Videx Videoterm)	21.95	**25.24**
U-Term (inc shift mod. & font editor)	127.00	**146.05**
Videx Enhancer II	83.00	**95.45**
Videx Inverse Eprom	18.45	**21.22**
Videx Utility Disc (inc font editor etc)	24.45	**28.12**
Videx Videoterm	169.00	**194.35**
Visicalc preboot disc (80 col with videx)	32.00	**36.80**
Vision-80 (incs softswitch & inverse)	185.00	**212.75**

MONITORS/COLOUR CARDS		
Digitek Colour Card (excellent colour on TV)	95.00	**109.25**
Microvitec colour monitor	275.00	**316,25**
Microvitec colour card (use with above)	35.00	**40.25**
Prince 12″ Green Screen	105.00	**120.75**
Zenith 12″ Green Screen (very good value)	79.00	**90.85**

GRAPHIC UTILITIES & MUSIC		
Arcade Machine (game designer)	23.50	**27.03**
Bit Stik (Robocom)	245.00	**281.75**
Complete Graphics System (Penguin)	65.00	**74.75**
Digitizer II	189.00	**217.35**
E-Z Draw 3.3 (excellent graphic utility)	25.95	**29.84**
Graforth (fast 3D utility plus music)	43.00	**49.95**
Graphics Magician (Penguin)	39.00	**44.85**
Graphic package Sublogic (detailed 3D pack)	74.75	**85.96**
Higher Text II (many diff fonts, sizes, cols)	25.45	**29.27**
Pascal Animation	41.00	**47.15**
Pilot Animation tools	41.00	**47.15**
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Versawriter (graphic digitizer)	165.00	**189.75**
Versawriter expansion pac 1	24.00	**27.60**
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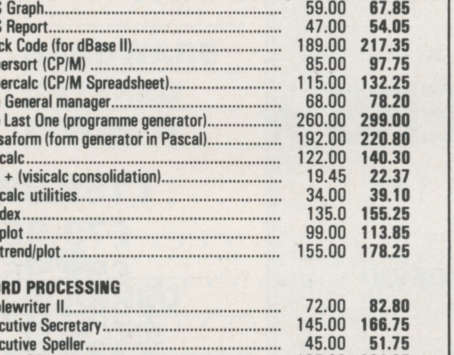

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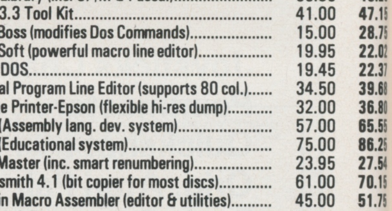

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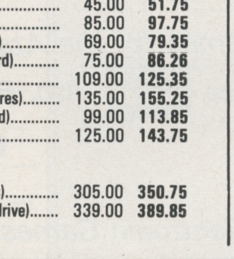

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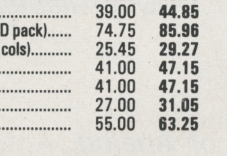

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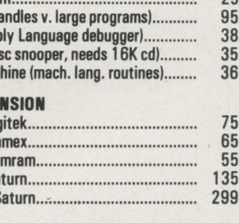

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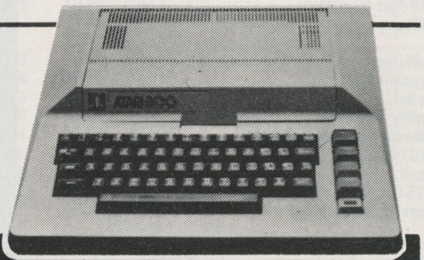

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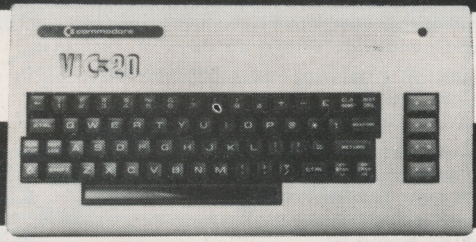

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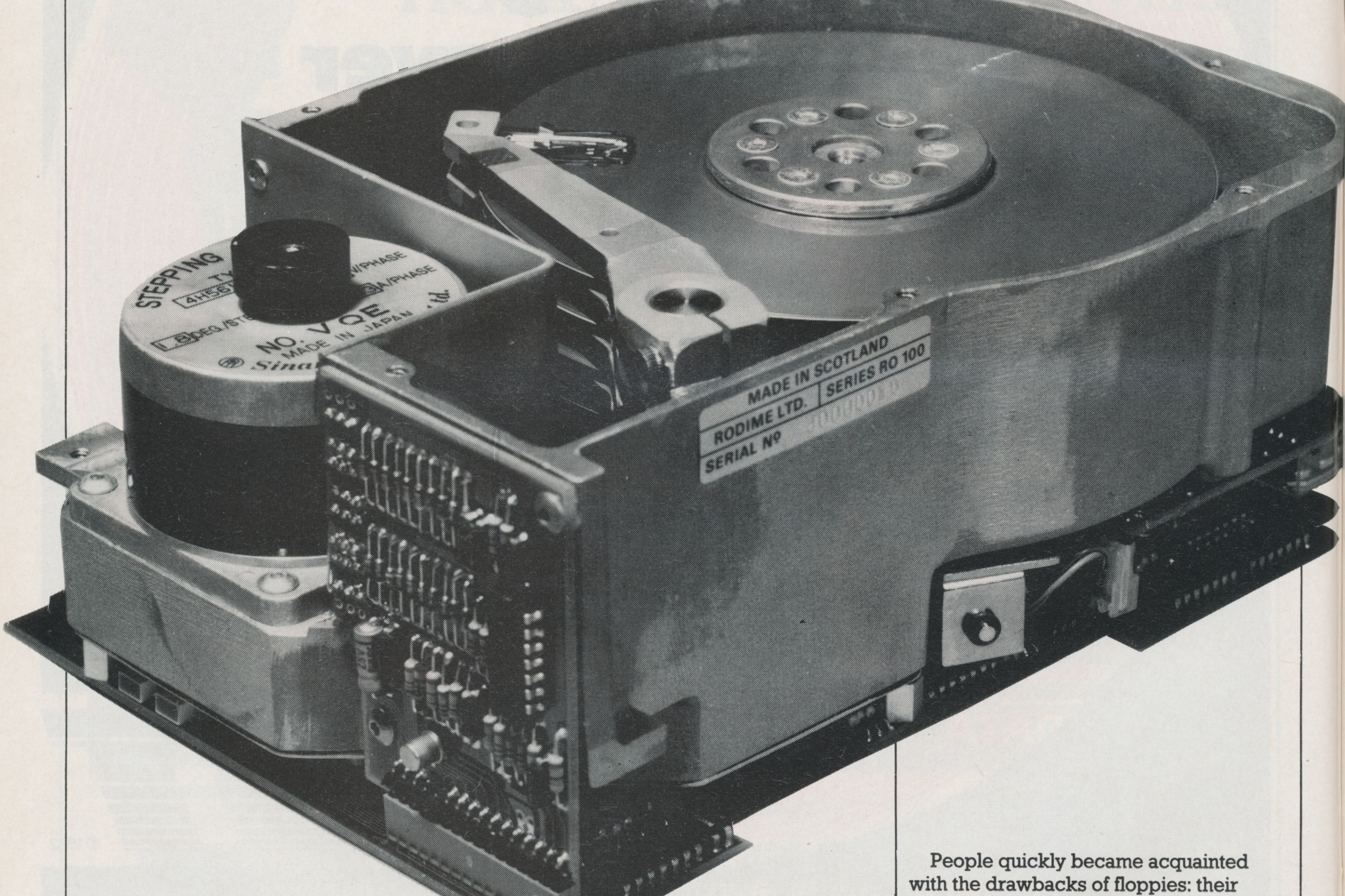


The name 'Winchester' for most people in the computer industry conjures up not a cathedral city in Hampshire but a disk for storing masses of data.

The first generation of microcomputers has accustomed most users to floppy disks: not an ideal medium because of their vulnerability (not to be handled after eating fish and chips!) and the limits on the amounts of data they can hold. The size and capacity of floppy disks has increased enormously since the first versions became common in the mid-seventies, but for many users the capacity of even the largest floppy disks cannot cope with their needs.

People quickly became acquainted with the drawbacks of floppies: their tendency to run out of space, and worse, to announce 'DISK ERROR' at the slightest excuse. Serious business use of microcomputers made it essential to provide a more robust and efficient form of mass storage.

The first to produce a form of hard-disk storage were pioneers who were prepared to rig up custom-built hardware and write the necessary software to store and retrieve data – usually in the lowest possible form of language, machine code. Although software houses (who really needed more storage space) could probably cope with such demands, the average end user needed something off-the-peg.

By 1980 Winchester disk technology had moved far enough to provide 8" Winchester disks for micros, although they were highly unreliable. One manufacturer who supplied these 8" disks as an optional add-on to his

HESTER DISKS

ALL YOU NEED TO KNOW

More and more business micro-computers now offer a Winchester disk drive as an option or add-on. What difference do these devices make, and are they worth the extra money? Will your software still be compatible? *Claire Gooding* takes a user's view.

microcomputer recalled that "at any one time we could be fairly sure that only half of the disks we supplied were actually working – the rest were either winging their way to us or back again after repairs!"

Reliable Solutions

As always, it didn't take long for the technology to advance to the degree that within only a couple of years there were far more reliable solutions in Winchester form.

The users who clamoured for mass-storage first were those who had bought Apples and PETs (Commodore) in the first wave of microcomputing. At the time few had envisaged that the PET would become one of the most widespread business tools of its time, but its popularity – and the fact that it ran out of space very quickly – meant that Commodore had to do something.

The solution was the Shark disk, made by Mator. The people who had invested in PETs were resourceful and adventurous on the whole, but couldn't really be expected to muck about with software – especially machine code – to get their programs to run on the hard disk.

"When Mator was approached with the idea of matching the PET with a hard disk, one of the prime requisites was that it should look like one of the existing drives," explained David Briggs, Hardware Sales Manager, for Commodore. "That way there would be the absolute minimum of software compatibility problems – if it works on the standard floppy, then it should work with the hard disk."

Meantime, Apple had found its own solution. First the Corvus hard disk came on the scene, then Apple followed with its own Profile.

Other suppliers developed Winchester bolt-ons for the many Z80-based machines. The only problem which such 'afterthought' bolt-ons might encounter was that most of the systems they were bolted to had never expected to talk to a Winchester. So unless the user was prepared to write his own Input-Output routines in machine language, he had to make sure that the manufacturer who supplied the disk also supplied a version of CP/M or whatever operating system was concerned, with the necessary BIOS (Basic Input Output System).

BIOS

The BIOS is a piece of software which allows the operating system to link with specific peripheral devices like disk drives and printers. It would be a pretty silly supplier who didn't ensure that customers could use his wares, so the BIOS problem is not a great factor – you'll find someone who can offer you a hard disk option among the many independent suppliers of bolt-on Winchesters which have sprung up in the last two years.

On the whole, moving to a Winchester shouldn't demand any alteration in your applications programs, the exception being if you have bought a system where the protection built into the programs as a bar to illegal copying, is connected with the physical disk – as in the Silicon Office from the Bristol Software Factory.

It didn't take long for the other manufacturers to realise that their systems would have an edge on competitors in the market place if they could offer Winchester disks as an option, so that buyers could later expand, even if they couldn't afford mass storage to start with. By 1981 such configurations were common.

By 1982, not only was the hard disk option common, but manufacturers were striving to improve the service they gave. Not all the space on a Winchester is used up, partly because some sectors are always kept spare, 'just in case'. Better organisation of data, so that operations are optimised, can mean an improvement on access times and throughput.

NEC offers such an 'improved' Winchester with its PC 8000, called DisCache. "What DisCache does is to keep the most commonly accessed pieces of data in a RAM buffer," explained Marketing Manager for the PC, Alan West. "With this technique the most frequently used bits of data are likely to be in the RAM buffer, so there's no disk access needed at all." West describes DisCache as "the most intelligent implementation of a Winchester" because it also deals with the eternal problem of backup.

"DisCache keeps a note of the sectors to which data was written, for example, daily. So that at the end of the day, it's only a matter of backing up that data, using only part of a floppy. With our system, backup becomes a simple end-of-day/month procedure. There's a complete management system for recovery, so that it becomes a simple serialised restoration of data: it never needs more than twenty diskettes."

Backup

Backup is one of the hidden costs of buying a Winchester disk. A complete backup needs as many diskettes as two dozen in some cases, and can be extremely tedious: prohibitively so if there's a need to make a complete backup every day. The alternative is a tape streamer, which can be pricey.

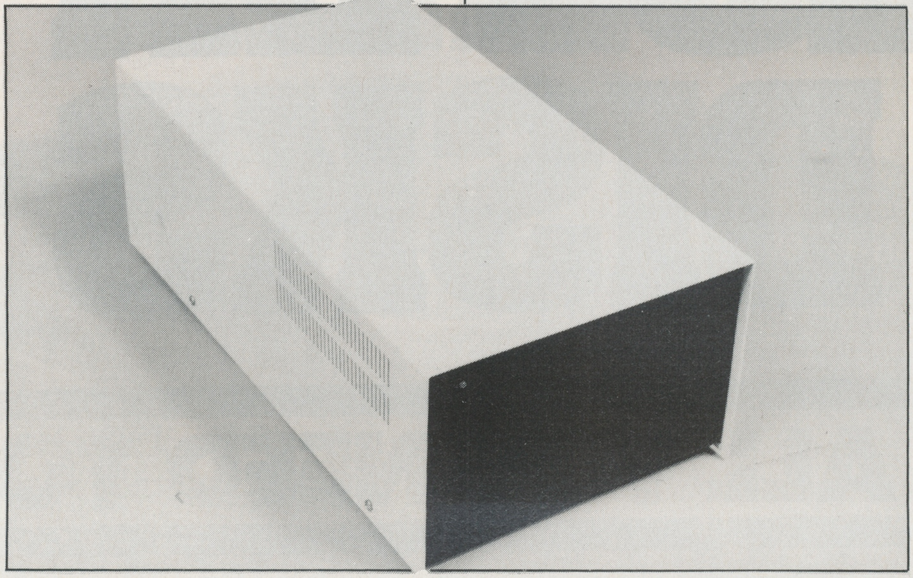
Just as frustrating, is the rare occurrence of re-formatting when there is a disk problem on the Winchester. "First of all," said one user, "you have to find the re-format program which you threw off the disk to make space months ago. It's then that you discover that the re-format – if you find it – is a pig to use with lousy documentation. Of course, it's so seldom used that you only discover this in real emergencies."

Nevertheless Winchesters have lots of hidden advantages, too. One of the busiest development areas these days is in operating systems, and manufacturers are looking beyond multi-user systems to networking. Compared to the home-computer user with his cassette or floppy, this is computing on a grand scale and couldn't be envisaged without some form of fast storage and retrieval.

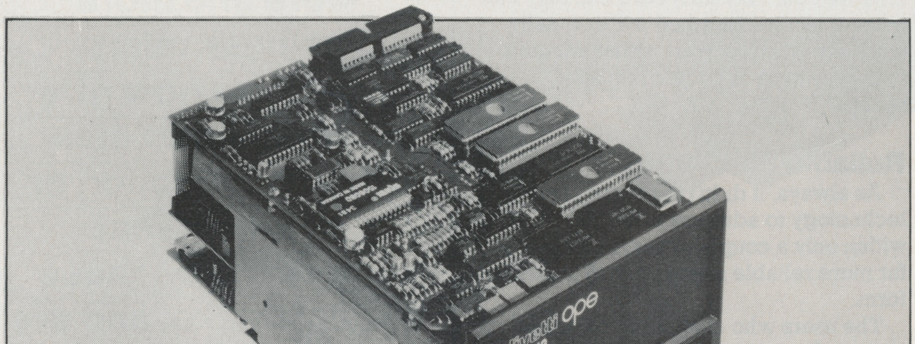
Newer operating systems – especially timesharing systems like the up-and-coming Unix, tend to assume that their targets run on Winchesters.

Having more storage should also have an impact on the people who are doing the actual development of software applications. Being able to hold data together all on one disk has repercussions on the 'integration' of software. Eventually we should see more sophisticated systems which perform automatic updates, or create one-off reports with data from many different files. Relational databases – notoriously power-hungry and greedy for space – become another possibility, and that means that users should be able to make any combination of data items, or 'relate' them, to make the kind of selective enquiry which most present systems are not flexible enough to allow.

Winchesters have already played a vital role in making software development easier, and it's likely that they will even lead to an improvement in the quality of software... or that's the theory, anyway.



Unlike a floppy disk unit, a Winchester frequently shows nothing on the exterior. Despite this, the level of noise is surprising high.



Tape 'streamer' cartridges are probably the best form of back-up to a Winchester disk, though most people use a floppy drive for reasons of economy.

Seagate Technology

New half-height Winchesters can be expected to appear on new microcomputers in a few month's time.

36 ▷

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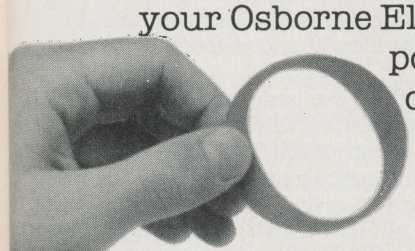

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WHAT IS IT?

For those with an insatiable appetite for technical explanations, here's a quick look at how a Winchester drive works.

The main thing that you need to know about Winchester disks is that they are larger – usually 5 to 10 times the capacity – than the floppies which have been the staple storage medium for most microcomputer users.

The main difference between floppies and Winchesters is that Winchesters are made of hard metallic material – hence the term 'hard disks', whereas floppies are just that – if you extract one from its cardboard shield you'll see something like those flimsy disks that used to be given away with magazines as advertising gimmicks.

The advanced technology used to create Winchester disks not only allows far more data to be packed onto a smaller space, but results in what should be a less troublesome medium than floppies. This is due to the fact that Winchesters are sealed in an airtight casing so that they operate in an immaculately clean environment. This means that the hard disk (in the raw it looks much like a brown LP) doesn't deteriorate as fast as a floppy disk because it is not subjected to the same sort of wear and tear, caused by dust particles and other abrasive matter. The pros and cons of putting all your precious data on to a Winchester disk are tied closely to that 'hard' medium.

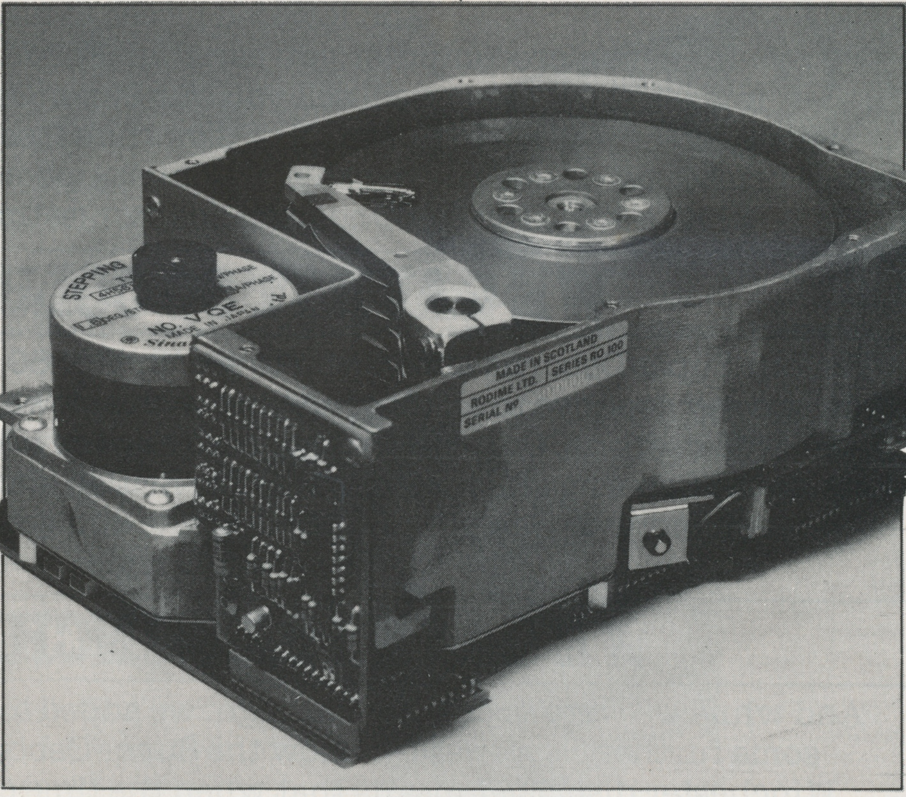
IBM first developed the technology, and stories abound as to how it came by the name Winchester. Sorry, Anglophiles, but most sources, including IBM, seem to agree that it wasn't named after a quaint Hampshire city: not directly, anyway. The engineers of IBM's development team named it after the Winchester rifle because the prototype disk drive supported two disks of 6 megabyte capacity – 6:6. The name stuck.

IBM's aim was to build an exchangeable disk pack with a very high data density. Previous attempts failed because the task of making the read-write head accurate enough to find the right track was almost impossible when the disk itself had to be exchangeable. The read-write head, which picks up data from the disk, had to be able to find the right track within thousands of an inch. Even if this were possible, the whole arrangement would go out of line as soon as the room temperature changed, because of thermal expansion.

Cushion of Air

IBM solved the problem by doing away with the disk-head alignment altogether. The head assembly became exchangeable, along with the disk. The sensor, which in older technology used to be part of the head assembly, was replaced with information held on the disk itself, and the head 'flies' across the disk on a thin cushion of air. The head must never actually touch the disk, which is travelling at about 100 mph – quite fast enough to cause a 'crash' which would damage the head and wipe out data.

The aluminium surface of a Winchester disk can be machined flat to a tolerance of around ten millionths of an inch, and the head flies about twenty millionths of an inch above the disk surface: about a hundredth of the diameter of a human hair.



A Winchester disk drive is hermetically (airtight) sealed to keep out dust and grime. The recording head 'flies' just over the surface of the disk drive on a cushion of air.

The thinner the cushion of air on which the head flies, the more data can be crammed onto the disk, in greater density. The problems are that flying as close as twenty millionths of an inch, the head stands a fair chance of encountering an almighty piece of dust, or a mountainous flake of cigarette ash. The solution: assemble the whole thing in a 'clean room' atmosphere, then seal it for life.

The Winchester's light low-flying head lands as gracefully as Concorde on the disk's surface only when the disk is turned off and slows to a halt. As a result Winchester heads don't need the expensive and unreliable mechanism, (rather like the needle on an automatic record-player) which on older-design hard disks was needed to lift and retract the head before the disk stopped.

So the development of the Winchester opened up possibilities of storing vast amounts of data in fairly robust conditions. It's hardly surprising, given the technology involved, that the Winchester disk was expensive. But it didn't take long for IBM's competitors to get on the trail, and prices dropped as the technology improved.

Practical Use

The first disks were 14" – too large to be of any practical use to microcomputer users. But once the teething problems were over, Winchesters began to look like a very attractive alternative to diskettes. Storage rates of 5, 10 or 20 megabytes began to appear in much smaller packages. By the end of 1980 8" drives which took up no more space than a standard floppy drive were becoming available in reasonable quantities. The price was relatively high, but the speed and capacity were ten times better than a floppy disk.

As the technology improves, the price is dropping as manufacturers make mechanisms simpler, and capacities have crept up from 40 to 80, and now even 450 megabytes.

The other thing that has changed drastically is the size. Winchester disks now come in even smaller sizes than the 8" drives. The next revolutionary step was the 5" or 5¼" disk drive, pioneered by Seagate, and now the 3¼" disk drives are making their appearance, heralded by Syquist's prototype, which drew the crowds at the National Computer Conference in the USA in 1982.

39 ▷

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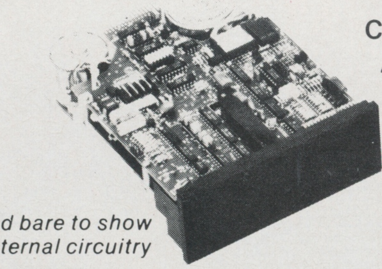

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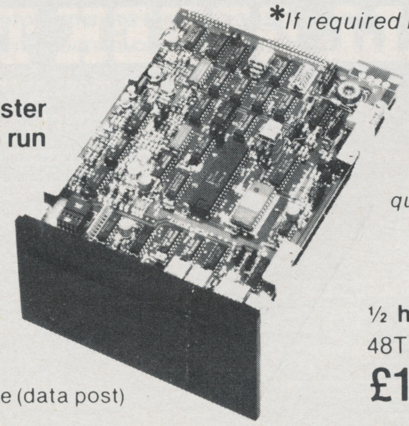

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WHO NEEDS ONE?

Not everybody needs a Winchester disk – but if you have a large database or want an integrated accounts system then a Winchester should be high on your shopping list

Who needs a Winchester? When you find yourself surrounded by a sea of floppies, when your accounting programs can't be run without switching and swopping, and when your operating system is forever hung up looking for spare sectors, then perhaps it's time you considered a Winchester.

It's the sheer lack of space which drives most users to consider hard disk storage, that, and the fact that having their data on a Winchester gives them a nice warm feeling of safety. The sealed disk appears much less vulnerable than a series of small floppies, which can get bent, have cups of coffee spilt on them, and can very often suffer from disk errors. The business of backing up at the end of the day is also so tedious that many people simply get lazy about it, and come to grief when their floppies pack up.

The other factor that pushes some users to the decision of spending a lot of money on a Winchester disk drive is speed. This can become a crucial factor with a micro which is being used for several different applications in a business environment. Not only does the actual disk access take much longer on floppies, but operators can take an inordinate amount of time shuffling data around to squeeze things in.

If there is some question of implementing a multi-user system then a Winchester comes higher up the list of priorities. Not only is speed more crucial in a multi-user environment, but the volume of data and programs is likely to be so great that the system couldn't work efficiently without a Winchester.

Database

The other software acquisition which demands a certain amount of hardware investment is a database.

The pros and cons of running one's business on a database are still debated up and down the land in mainframe installations, but for users who are considering a set of applications depending on one set of data, it's a solution worth consideration.

There are several microcomputer databases (Logica's Rapport, Pactel's MDBS) but the use of any of them – or even the data files created to run, say, a stock system, can take up a great deal of space. Depending on the access method used and the number of data items, a large set of files can slow operations down considerably. "All I can say about anyone who tries to run a database off a floppy," said one user, "is that they must be very, very, patient."

Until recently, Winchesters were only available as add-ons from third-party suppliers (this Corvus unit is one of the most popular). Now more manufacturers will be offering their own.

Nevertheless the collection of your data and its organisation into a database can have some valuable spin-offs, especially to a business user. It opens up the possibility of 'integrating' operations. This means that instead of executing each task independently and perhaps only updating one file, updates which have a bearing on one set of data – for example the stock file and the supplier file – can be automatically posted. When creating a report, data from several different areas can be called on, and individual programs can all tap the same data.

There are great advantages in this approach, since expanding operations (perhaps adding a payroll) can use information that is already filed. A business user who wants to make the most of the great amount of information stored in his files can also think about such applications as modelling and forecasting; again, a very space-hungry sort of operation because of the mathematical formulae used to manipulate large amounts of data.

Program Generators

Most of the space needed to run integrated applications, or a database system, is taken up by the tables and pointers which have to be set up as a sort of index to link the various pieces of related data. The more links there are, the more space is needed for the tables.

The other way of creating applications which link together is to use a sophisticated applications generator. These have become very popular in the last couple of years, with products like the Last One, and Personal Pearl becoming almost household names. These can be very effective, but nearly all of them work on the same principle: menus which lead the user through the business of setting up a database, linking data and setting up 'keys' on which data is sorted (e.g. customer number or surname), and then actually creating the application.

In this case, not only do you need space for the files you create and the tables and indices that they use, but even more space for the heavy business of generating code. Code, which is generated rather than hand-written, tends to be less efficient because it has to be 'ready-made', and it will often take up more space and work more slowly than custom-built programs. If you are planning to use an applications generator then a Winchester disk may well be a necessity, since it is easy to run out of space on floppies when creating only one small system.

Software houses tend to go for mass storage of some sort for the obvious reason that they have far more to store, and will often keep several 'development' versions of one program, plus sets of test data.

If you have an accounting system or stock system which has been written specifically to run on a pair of floppy disks, then you should be able to manage quite well without hard disk storage. However, transferring the system to a Winchester will make a difference in speed and efficiency, though it probably isn't worth the effort unless you plan to expand in some other way. ○

Next month we shall be looking at the pros and cons of using a Winchester system, as well as a more detailed look at who's supplying what.

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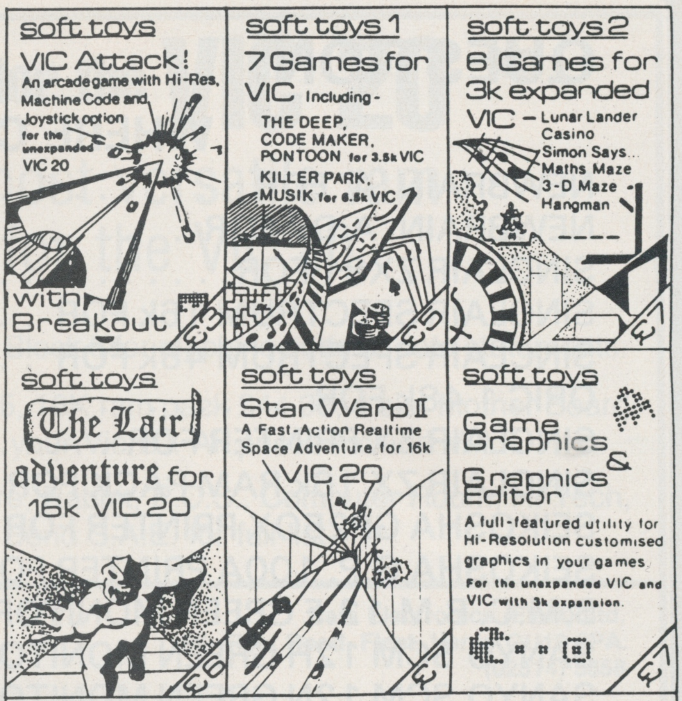
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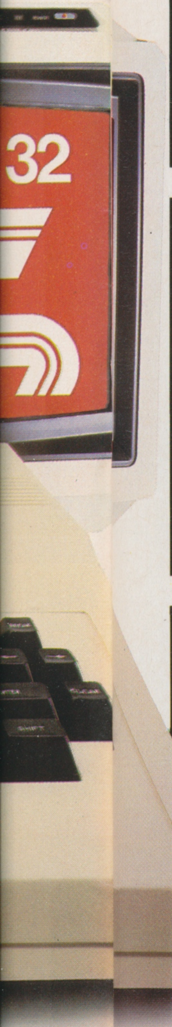

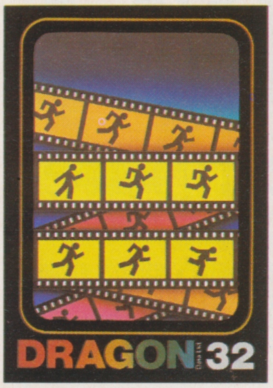

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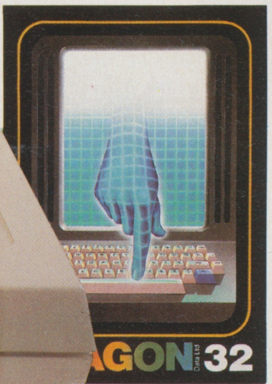

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```
TO:   Frank Hollister

FROM: Kevin North

RE:   Staff Meeting

Frank,
          This memo is to remind you of our staff meeting,
which will be held this Friday at 10:00 a.m. in the board-
room.  The major objective of this meeting will be to review
the sales figures for the past fiscal year, and to project
what level of business we can realistically expect to achieve
next year.

          I think we all recognize how important this meeting
will be.  The marketing manager will be in attendance to help
us target key accounts for our sales force.  Hopefully, by
the end of the meeting we will have a well defined strategy
to help us meet our objectives.

                              Regards,
                              Kevin

Console=1 Dynamic    Printer=0     MEMO     14:17:26 Wrap
```

```
                            Friday
                ________________________________________
   9:00 - 9:30  Weekly project status
                ________________________________________
 10:00 - 12:00  Staff Meeting
                Note:  Marketing Manager will attend
                ________________________________________
 12:00 - 1:30   Lunch with Jenny
                ________________________________________
  2:00 - 3:00   Interview J.S. for Marketing Rep Position
                ________________________________________
  4:30 - 5:00   Review Daily Mail
                ________________________________________
  7:00 -        Bill and Penny coming for Marketing Rep Dinner
                ________________________________________

Console=3 Dynamic    Printer=0     CALENDAR 14:30:00 Wrap
```

```
              January Journal for David Ashley

Number  Account       Date      Amount       Description

 1000     103       10/1/82      12.40       Gas bill
 1001     210       10/2/82      20.00       Cash
 1002     107       10/4/82      42.36       Electric bill
 1003     205       10/5/82     131.40       Car repair
 1004     403       10/9/82      51.50       Food
 1005     342      10/11/82       9.25       Toys
 1006     109      10/13/82      75.42       Phone bill
 1007     142      10/15/82      45.21       Records
 1008     120      10/19/82     330.40       House repair
 1009     404      10/21/82      32.50       Dinner
 1010     167      10/22/82      29.20       Cable TV
 1011     100      10/24/82       0.00       VOID
 1012     202      10/25/82     242.06       Airplane ticket
 1013     132      10/27/82      62.50       New chair
 1014     303      10/30/82      42.10       Theater tickets

Console=2 Dynamic    Printer=0     BILL     14:23:07 Wrap
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Console=0 Dynamic    Printer=3     BAR      13:04:00 Wrap
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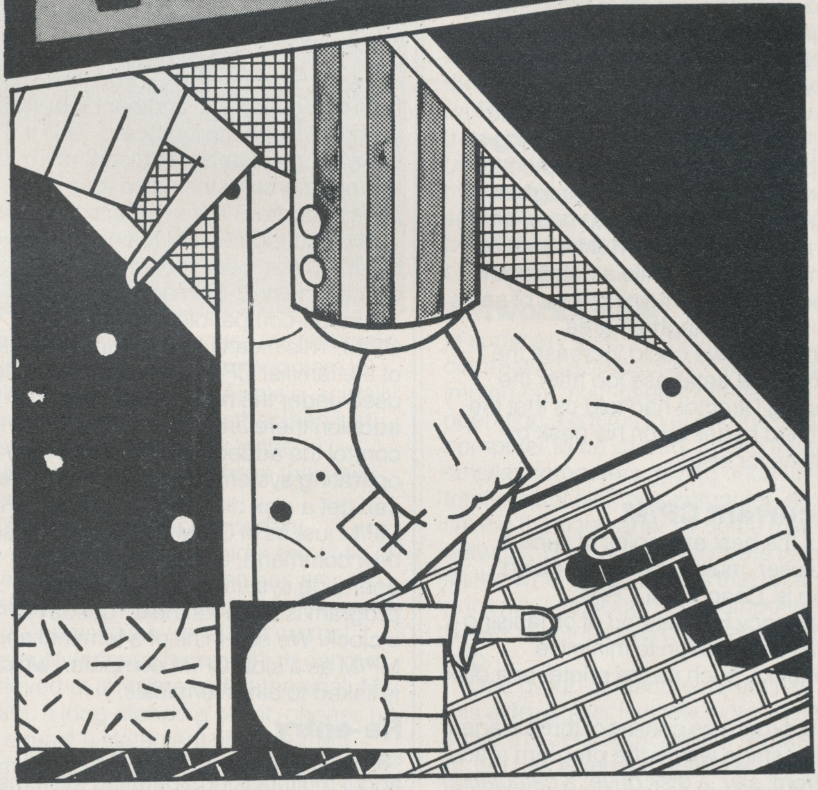
MULTI WHAT?!



Multi-user, Multi- tasking, Multi-processing – it seems that almost every new business computer sports at least one of these buzz-phrases. But what do they all mean to you, the user, and which one is right for your needs? *Chris Preston* provides a beginners explanation.

Once upon a time, microcomputers were nice and simple and so were operating systems. You either bought a machine like the PET which came with BASIC in ROM, or one like the Apple which also had BASIC in ROM, but a DOS (Disk Operating System) which was loaded (or booted if you like jargon) from disk, or you were really advanced and bought a CP/M machine where both the operating system *and* BASIC were loaded from disk. Each of these machines did in fact have an operating system, but it was either so crude that the manufacturers preferred to ignore it, or even in the case of CP/M, was simple enough to just call 'The Operating System', without worrying what *kind* of operating system.

Now, unfortunately, manufacturers and salesmen have learned new words to bludgeon us with: 'Multi-User', 'Multi-Tasking', 'Foreground', 'Concurrency' and many, many more!

What do all these new concepts mean to the customer? If your answer to that is, 'Not a lot', then read on.

Multi-User Piano!

If we go back to CP/M as an example (although the same applies to nearly every small 8-bit micro, whether or not it has a separately identifiable operating system), we can classify it as a 'single user, single tasking operating system'. This means that only one person can operate the computer at one time (at this point Tommy, who is peering over my shoulder hoping to learn something, has told me that he once saw a program on the TV where 10 people played a famous piano piece on one piano, using one finger each! He wants to know if that makes it a multi-user piano? I shall ignore him).

It also means that the computer itself can only do one thing at a time, so that while the printer is printing you cannot use the keyboard to enter more data (note to Wordstar users: I know you can print and enter data at the same time on some micros, but here it is the program which is being clever, not the operating system).

Now this is quite a wasteful restriction, because a computer, even a small micro, can carry out hundreds of thousands of operations per second, whereas even a gifted typist cannot beat 10 keys per second for very long, and 200 characters per second is quite fast for a microcomputer printer. This means that the computer is spending a large amount of its time just doing nothing except waiting for something in the outside world to happen. We say that the computer is *I/O-bound*, where *I/O* is short for *Input/Output*.

This means that, with a bit of extra work on the part of the operating system designer, the processor can do both tasks at once, without apparently losing any time; the typist does not notice any deterioration in the response of the computer because there is none: the computer is spending some of the wasted time in between key depression to drive the printer.

What we have now is called a *Multi-Tasking* operating system, because the computer is doing two things at once. O course, one computer cannot really do two things at once, what actually happens is that it switches between two or more different tasks many times each second, so quickly that you cannot notice it changing over. However, it is very convenient to be able to talk of two things happening at the same time, so we will continue to do so, but still bear in mind what is really happening.

Foreground-Background

The simplest form of multi-tasking syste is called a *Foreground-Background* operating system, where we have two tasks running at the same time. One is

▷

an operation such as printing, which can be carried out 'in the background', without needing to use the screen or keyboard. The other is called the foreground job, and it is this job which actually uses the terminal. In this way you can carry on typing data to the foreground job while the background job is busy using a printer or telephone line.

By building up the complexity of the operating system, it is possible to have even more than two jobs going on at once. This is done by allocating each job a certain time period, called a *time slice*. When the time slice has run out, the job is stopped and another one started. By giving different jobs longer or shorter time slices, or allowing some jobs to come in more often than others, an important job can be given a high priority so that it runs faster than a low priority job.

As an example, in a fully automatic office, the computer may be running a word processing program coupled to the terminal, an accounting program printing statements to customers, an order processing system linked to the telephone system, while a database is producing a file containing a list of sales leads in the Birmingham area.

In this case we could increase the priority of the database job after the Managing Director had told us that the report had better be on his desk by lunchtime, or else!

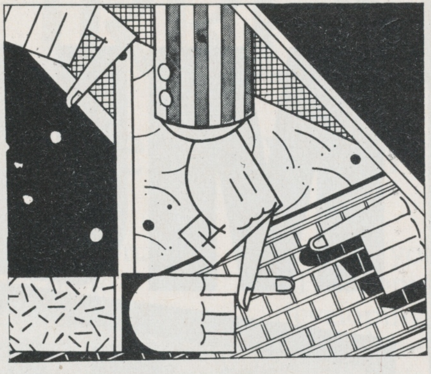
Concurrent CP/M

One of the best examples of such a single user, multi-tasking operating system is 'Concurrent CP/M'. Concurrency is a method of organising the way jobs are run to minimise bottlenecks, such as the printer or a disk drive.

Most programs consist of three stages: an *input* stage where the program reads data from, say, a disk drive; a *calculation* stage where the results are calculated and an *output* stage where these results are sent to a printer or back to the disk drive. If three jobs start at the same time, they are all likely to want to use the disk at the same time, which is not very efficient. A concurrent operating system schedules jobs so that the second job does not start until the first job has entered its calculation phase, leaving the disk drive free. This process is called *overlapping* and different operating systems vary in how much overlap occurs between jobs.

Concurrent CP/M runs on the 8086/8088 16-bit processors, and allows a number of jobs to be run concurrently, effectively letting each one 'think' that it has its own computer console. One job uses the real console and runs just like a program running under standard CP/M. The other, background jobs, can send their output to disk files, where it can be looked at later, or can maintain an imaginary screen in the computer memory.

In this mode the operator can switch from one console to another by pressing a single key on the keyboard. This is just like having a number of monitors arranged around the office and physically moving from one to the other.



The computer is spending a large amount of time just ... waiting for something in the outside world to happen

Both Concurrent CP/M and the earlier MP/M, a multi-user version of CP/M which runs on 8-bit machines, are 'upwards-compatible' with ordinary CP/M. This means that all (or nearly all) of the familiar CP/M commands can be used under the new system, but in addition there are new commands to control the added features of the new operating system. So, for instance, we can get a disk directory by typing DIR in MP/M just as in CP/M. We can also use a new command, SCHED, to tell the operating system that a particular program is to be run next Tuesday at 12 o'clock. We can think of a terminal under MP/M as a slow CP/M computer, which is linked to other terminals.

Re-entry

Have you noticed that people talking about multi-tasking operating systems very rarely talk about programs, but about 'tasks' and 'jobs'? This is because a 'program' in the normal sense does not have much meaning in such a system. If we are running a word processing system and an acccounting system, then we can indeed identify a word processing program and an accounting program, although they may not both be in the computer memory at the same time.

However, if we have two jobs using the same program, say two different searches on a database, there will only be *one* copy of the actual program in the computer, which is *shared* by the two jobs. A program which can be shared in this way is called *re-entrant*, because one job can be running, then stop while another job uses the code, then 're-enter' the code where it left off and carry on as though nothing had happened!

If two different programs are running at the same time and the program code has to be loaded from disk each time a job starts because there is not enough room in the computer memory for both programs to be resident at the same time, the disk drive would be constantly tied up. So having a *re-entrant* ability will save both computer memory, and the need for an ultra-fast disk system.

It is not absolutely essential for a single user, multi-tasking operating system to support re-entrancy, because most of the time there will be only one copy of a program required at any one time; you don't often run two word processors at once (although Concurrent CP/M does allow this).

However, it is vital when we go to a full all-singing-all-dancing system, the multi-user multi-tasking operating system. This is just like a single user multi-tasking system, except that the computer has a number of terminals (a large mainframe can handle over a thousand terminals at once!) and hence a number of operators. All these operators share the main computer, its memory and its disk drives, so if seven of them are running the same program, it would be extremely wasteful to have seven copies of the program in memory!

Record-locking

A feature of these sophisticated operating systems is that a great deal of attention has to be paid to the problem of file integrity. If we have two operators or programs both running a stock control system, say, they could both read the file record for Widgets, and see that there are five still in stock. If one now sells a Widget, and the other sells three, there is in fact only one Widget left, but one terminal will write back a record saying there are four Widgets left (five originally in stock less one sold), and the other will write back a record saying there are two in stock (five originally less three sold).

The second terminal will overwrite the record written by the first, so depending upon which operator writes the updated file record back last, the file will say that there are four or two Widgets in stock.

To get round this, a multi-tasking operating system uses a method called *record locking*. If a job reads a file record (such as the stock record for Widgets), then *no other job* can read the record until the first one has released it. The sophistication of the record locking system greatly affects the efficiency of the operating system; some, for example, only have file locking, which means that if one user has read the Widgets record from the stock file, the *whole* of the stock file cannot be used by other users until the first has finished with the record.

This is very wasteful, and can cause large delays if there are a number of users using the same file, so if you are trying to decide between two operating systems, it is important to make sure that the one you get has a decent record locking facility.

Spooling

A similar problem is that of handling a shared printer. If two jobs both want to print at the same time, we need some way of separating the two lots of data, otherwise the printout is going to look rather a mess!

This process is known as *spooling*. What happens is that both programs send their data to a file called a *spool file*. The operating system, which alone has control of the printer, then sends the data in a spool file to the printer, so that the data from different jobs does not get mixed up. As an aside, it is interesting to note that each job thinks that it is using the printer, but in fact the data is intercepted by the operating system and diverted to the spool file, from where it is sent to the printer under the control of the operating system.

So far we have looked at ways of letting several people and tasks share one computer, but there is another approach. The basic problem is to let several people share one central data store on a disk or disks, and possibly share a printer as well. So instead of sharing the computer itself, which is what all these fancy operating systems do, we can have several computers linked together.

We now have a range of possibilities, ranging from *multi-processing* to a *networking* system.

Multi-processors

Although there is a large grey area where the two types merge into one another, multi-processor system can be differentiated from a network system basically by the fact that each computer in a multi-processor job has a *different* job to do and tend to be close together; in a network, several computers do the *same* job, although often hundreds of miles apart. An example will make this clearer.

A typical small multi-processor system is a home microcomputer with a printer! If you look inside the printer, you will find that it too has a micro-processor inside it, so we have a two processor system, one dedicated to controlling the printer, another to doing the actual computing. In larger systems, mainframe computers often use minicomputers as *front end processors* to control a number of terminals, leaving themselves free to concentrate on the data going to and from the terminal, without having to worry too much about controlling the terminals and trying to get telephone connections and so on.

In a network, on the other hand, we tend to have a number of similar machines linked together, perhaps one or two in each branch of a large retailing organisation, each of which is physically identical, running the same program. Usually at the heart of the network we have a central computer of some sort which controls the central database, implementing record locking and printer spooling just as on any other multi-user system.

Intelligent Terminals

One common use for a network is to connect a number of *intelligent terminals* to a mainframe. In this case the terminals, which may well be microcomputers in their own right, such as Apple's, actually have some work to do, rather than just passing messages back to the mainframe, and usually have their own floppy disks.

IN A WORD...

Multi-User	A system that allows more than one person to use it at once: i.e. can support more than one screen and keyboard
Multi-tasking	A sophisticated operating system that lets a single-user system operate more than one program at once. Example might be keying in a data file whilst sorting another one.
Concurrency	Alternative word for multi-tasking. i.e. lets you run several jobs concurrently.
Spooling	Crudest form of concurrency - lets you print out a document whilst doing another job on the computer.
Multi-processor	Computer system in which there are several distinct processors – each performing a different job.
Network	Computers connected together for the purpose of transferring information from one user to another.

This has some very important advantages. Let us consider the case of an investment broker, who has an intelligent terminal linked to a mainframe. On the mainframe are all the current prices of various shares, which can be retrieved at any time by the terminal. Mr. Smith, a long-standing client, phones up to request a statement of his current portfolio. To do this, the terminal consults its own file, which tells it exactly which shares Mr. Smith holds, how many of each, and the price when he bought them. It can then contact the mainframe, and find out how those shares are standing at the current time.

Manufacturers who are following the shared-computer path are living in the past.

From all this information it can print a detailed report for each share, showing whether he has a profit or a loss.

Now the important thing is that the only time the terminal needed to consult the mainframe was to find out the current price of the shares. All the data entry, calculations and printing is done 'off-line', that is without intervention from the mainframe.

From the point of view of the mainframe, this means that it can handle more terminals, doing other work at the same time, and in addition, the broker's own customer files are held on his own disks, and do not occupy precious space on the mainframe disks. From the point of view of the broker, he saves rental costs on the mainframe (which are based on how much computing time, called *mill time*, he uses), and telephone bills.

Also, because all the calculations and printing are done by a program on his own premises, it is much easier for him to alter the program to suit his own requirements.

On the other hand, if the broker only had a 'dumb' terminal, that is one without any built-in computing ability, *all* the information would have to be held on the mainframe's disks, together with a few thousand other brokers' files. All the calculations and printing would have to be carried out by the mainframe, although it could control a printer at the broker's site. All this is very expensive for the broker, although it is good news for British Telecom! It can also be tremendously difficult for an individual user to have modifications done to the mainframe program to handle his own special requirements, and it is liable to be a long-winded and expensive process.

Networks rule!

In summary then, we have two contrasting approaches. The first is to implement multi-user, multi-tasking operating systems to allow one large computer to be shared among several, smaller computers, giving each user total control over one computer, and linking them together by some means of network. The price of hardware is falling all the time, which means that for a given price, you can buy more computing power now than you could a year or two ago.

One group of manufacturers has used this extra power to allow more users to share the central processor. Another group has taken the networking path, spreading a number of cheaper computers around, linking them together by means of hardware to form a network. Which approach is the better?

Well, I personally see the future in terms of the network, especially one consisting of a large central computer supporting a number of intelligent terminals with local storage and printing. The advantages of such a system are its flexibility (as explained above, for example, each terminal can have its own custom-made program), and reliability.

By spreading out the computing amongst a number of terminals, any one terminal being faulty does not stop the whole system, unlike the shared central computer, where a fault will stop all the terminals. With the intelligent terminal system, even if the central computer goes down, local processing can still often be carried on using the computing ability of the terminals.

In my opinion, the manufacturers who are following the shared-computer path are living in the past, when hardware was extremely expensive. Networks for me! ○

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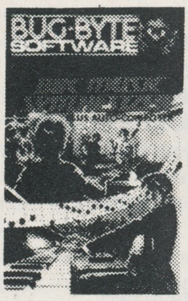

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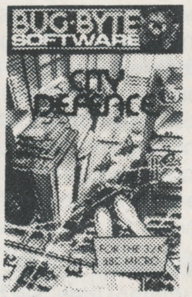

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In addition to the disc pack a second processor is supplied. This is a Z-80A with its own 46K RAM card, communicating with the 6502A in the BBC computer through the 'Tube'. Typically the speed of execution of programs under the twin-processor system is increased by up to 50% compared with a conventional single-processor computer.

A third processor, the 16 bit 68000, will shortly be available.

TORCH CF240	£2,795.00 (Ex. VAT)

This an extension of the BBC microcomputer/Torch disc pack system, available in a single unit. The computer contains a BBC based peripheral processor connected to the main Z-80 computer, a dual 2 × 400K disc drive as described above, a high resolution (80 character) colour monitor and a complete British Telecom approved 1200 baud modem. It is the only microcomputer which has been granted permission for direct connection to the Public Switched Telephone Network both in the U.K. and the United States.

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COMPUTER music

is gaining ground both in the Rock industry and amongst computing enthusiasts. *Boris Sedacca* looked at what today's home computers have in common with top flight synthesisers costing thousands of pounds.

Programmers are like composers. Soon they will be. The technologists and musos are on a collision course. Last year, the Central London Branch of the Musicians' Union voted to get synthesisers and drum machines banned from recording sessions.

Neil Lancaster, a pianist and orchestral arranger who proposed the motion complained of "the escalating misuse and abuse of electronic devices that imitate and simulate musical instruments."

"Nothing short of an all out effort to halt and banish this phenomenon of plagiarising our skills will do," he added. "A myriad of virtually non-musical, non-musician megalomaniacs dictate, procure and purvey our craft and our creativity to a totally defenceless consumer."

Strong words indeed. ▶

On Green Dolphin Street
Ned Washington
Bronislau Kaper
Moderately
Lov-er, one love-ly day. Love came, planning to
stay. Green Dolphin Street supplied the setting, the set-ting for
nights beyond for - get - ting.
digital VT100
Synclavier II

Organ Grinders

It is not the first time musicians and technologists have fallen out. Computer pioneer Charles Babbage achieved notoriety in his day for his attempts to have organ grinders banned from playing in the streets. Naturally, their response was to stand under his window and perform until he came out and chased them down the street hurling abuse at them. So even in those days the technologists were finding ways to program musical instruments – someone had to build the mechanisms inside these organs which would make them play the correct notes in the correct sequence in order to allow their operators to turn a handle with one hand and to hold a begging bowl with the other.

Another example of early musical technology is the pianola, a keyboard instrument which plays by itself under the control of punched paper tape or small punched cards which have been stitched together. As the notes are struck, their corresponding keys on the keyboard move down as if they are being depressed by invisible fingers.

Electronics has brought increasing sophistication to modern musical instruments, particularly in the case of keyboards, while at the same time bringing their costs down. Electronics provides computation, and computation is made up of two elements: processing and memory.

In the past, synthesiser manufacturers tended to concentrate on the first – on processing signals to improve the sound coming out of the instrument. Where memory was used, it was in subservience to the main goal of enhancing the sound. For example, synthesiser manufacturers typically offer memory facilities to allow the musician to store settings for sounds he has discovered.

Intelligent Keyboards

It was only a matter of time before someone realised the potential of using memory to provide intelligence on a keyboard instrument and so far it looks as though the Japanese have taken market leadership once again. Two companies stand out in particular: Roland and Casio.

Before outraged synthesiser manufacturers start sending a flood of letters into this office, the above statement needs to be clarified. The choice of words 'market leadership' applies to the price of the instrument against its facilities – it is here that the Japanese score against their Western competition and look more likely to achieve market penetration. (Sorry about the Harvard-style buzzwords).

As far as technological leadership is concerned, this area is hotly contested by two main contenders, the Fairlight CMI (Computer Musical Instrument) and the Synclavier.

Anyway, to get back to intelligent keyboards, this term applies not only to ▷

BEST SYNTHESISER

When it comes to top-flight synthesisers, the state-of-the-art is represented by two machines, the Fairlight and the Synclavier.

This is not the monopoly of one machine but a duopoly dominated by the Fairlight and the Synclavier. Both machinesare digital synthesisers and both are expensive. With the Fairlight you can expect to shellout at least £15,000.

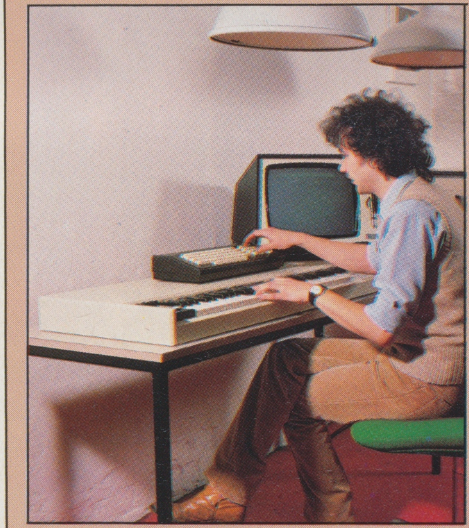
With the Synclavier, you will be lucky to get much change from £20,000 if you take on all its available features and the technical specification looks more impressive than the Fairlight. But if the Synclavier is the Rolls Royce of synthesisers, the Fairlight must surely rank as a Ferrari at the very least. Both machines have their finer points and in the final analysis, it depends on what kind of driver, sorry musician, you are.

The Fairlight uses two Motorola 6800 microprocessors back-to-back which operate on alternate phases of the clock to provide a 16-bit digital to analogue (D to A) signal resolution, while the Synclavier uses a custom-built 16-bit minicomputer with its own instruction set in microcode specifically oriented to signal processing applications.

Dual Processor

Fairlight says it will soon be using a dual-processor 6809 architecture. Not to be outdone, New England Digital, Synclavier's manufacturer claims its minicomputer is capable of being expanded to 32-bit, thereby increasing the processor speed five times. This processor incidentally, was designed under a university grant at Dartmouth College (that's right – where the programming language BASIC was invented) as far back as 1976. The Fairlight was designed around the same time back in Australia.

The Synclavier minicomputer processor also uses a dedicated language called XPL which, according to NED marketing and sales director Bradley Naples, gives it the edge over systems based on 6800 microprocessors which have to rely on assembly language (in other words the Fairlight). Furthermore, the Synclavier



The Fairlight (above) features a dedicated Music Composition Language while the Synclavier (below) will eventually support a 32-bit processor and Winchester disks.

4408
Synclavier II
DIGITAL SYNTHESIZER
ENVELOPE GENERATORS
16 TRACK DIGITAL MEMORY RECORDER
PITCH AND HARMONIC CONTROL

will also have Winchester disk drives with bigger storage capacity whereas the Fairlight only uses floppies.

This is all very well as far as technical details go, but what do these machines actually do? Have they got anything to show for all the technological pizzaz?

Let us start with the Fairlight. This comprises a graphics terminal with light pen, a processor box containing circuit and memory cards as well as twin eight inch floppy disk drives, and a six-octave keyboard.

Unlike the Alpha Syntauri which drives digitally controlled oscillators to create waveforms on slot-in cards made by Mountain Hardware for the Apple II micro, the Fairlight stores its waveforms in 16K memory areas for each of its eight voices which are then fed to a D to A converter and then to an audio output.

Composition Language

Waveforms are created by synthesis or by sampling and manipulated by numerous techniques, a full account of which would make rather boring reading, although it is this feature which everybody raves about. Keyboard players being essentially performers, do not seem to be as enthusiastic about other features which deserve more attention such as the sequencer and the Fairlight Music Composition Language (MCL).

The sequencer operates like a tape recorder. A sequence of up to 30 minutes can be recorded directly from the keyboard for up to eight voices. Alternatively, eight monophonic tracks may be recorded and played back together. The MCL composer allows music to be entered through the alphanumeric terminal keyboard for note pitch, duration, key impact velocity and gap time between notes. Repeats may be entered and compositions of up to eight parts are possible, each of which may access up to 32 sequence files holding up to 2,000 notes.

The Synclavier appears to offer all the facilities of the Fairlight and more, for instance 16-track recording instead of eight. Digital recording means that when keyboard performances are played back, they may be slowed down or speeded up without changing the pitch as would be the case with conventional tape recorders. Conversely, the key of a performance may be transposed without changing the speed.

Track bouncing

The system provides 32 voices, each of which has the digital equivalent of 24 oscillators – the same number of analogue oscillators would be impossible to calibrate without ridiculously complex and expensive circuitry. There are also a number of fancy track-bouncing features: for example, a trumpet track can be duplicated onto another track and its voice changed to, let's say guitar, for the two instruments to play in perfect unison, or even in harmony by transposing the pitch of one of the tracks. Sounds are loaded in from floppies, each of which may contain up to 64 sounds.

The Synclavier composition language, Script, follows the line numbering format of languages like Basic and Fortran. It appears powerful but cumbersome too. However, one thing which makes Script stand out is a 'reverse compiler' facility which translates a keyboard performance sequence into Script notation. So if your style or timing is a bit dodgy you can get a Script listing of your composition which you can then edit.

One could go on and on describing features, but the only way to understand the machine is to see it in the flesh. The UK distributor for the Synclavier is Turnkey in New Barnet. The Fairlight is available from Syco Systems in London. ○

▷the narrrow definition of programmability as given to synthesisers by their manufacturers when referring to the ability to store sound settings, but to go the whole hog and store complete musical sequences as well.

This provides non-keyboard players with the ability to imitate the sounds of all types of musicians as well as the ability to imitate their performances. Can you blame the MU for getting paranoid? Well, it is interesting to note that pianolas did not do away with piano players. Perhaps the reason why pianolas are on display in museums instead of pianos is that the technolgy of the time was not advanced enough.

Musical Notation

With a system like the Fairlight or the Synclavier, the composer, the musicians and the conductor are rolled into one person. What's more, that person does not need to be able to read or write conventional musical notation. If he or she can play a guitar and has just a grasp of fundamental music theory, he/she can probably write music by using a computer based composition language, though some people may be more coy about learning computer programming than about learning music theory.

There is in fact a Canadian-based organisation called the Chroma Foundation which aims to devise an alternative musical notation better adapted for interpreting the chromatic scale. It argues that musicians in all countries are agreed that conventional notation of music no longer meets the needs of modern music. The foundation is carrying out an enquiry on an international scale to investigate proposals for a new notation and the means of agreement on a new notation.

Its intention is not to supercede the notation of the older music by a new one but to find a new notation for newer music within the scope of the chromatic scale. "We are looking for a new method of musical notation for compositions within the scope of the chromatic scale, as opposed to the conventional diatonic▷

MUSIC ON YOUR MICRO

Most home computers now feature some form of sound functions. Here's our quick feature-by-feature comparison.

	No. of octaves	No. of voices	White noise	Envelope shaping	Soft volume control
Spectrum	4	1	NO	NO	NO
Vic	3	3	YES	NO	YES
TI99/4A	5	3	YES	NO	YES
Atari 400	3	4	YES	NO	YES
Dragon	5	1	NO	NO	YES
BBC	5	3	YES	NO	YES
Commodore 64	9	3	YES	YES	YES
Oric 1	6	3	YES	YES	YES
Lynx	*	1	*	*	YES

** Uses an A to D converter so special effects can be done with sophisticated software.*

▷notation," it explains.

There are three important criteria for this new notation. Firstly, it should represent music graphically, that is to say, the configuration of notes and the musical progression should be rendered by purely graphical means. Secondly, the notation should be easy to write in freehand without technical aids, and thirdly, the notation should be easy to read, that is , the trained musician should be able to sight-read it without difficulty. Musos Beware!

Self-indulgent

Getting back to the equipment, although nothing sounds as good as the real thing, no matter how advanced the machine, some people are prepared to sacrifice quality if it will save them money and that is the primary issue, the raison d'etre of computer music.

Those of you who saw Peter Gabriel on the South Bank show with Melvyn Bragg late last year may remember that after a lot of self-indulgent experimentation collecting sound effects such as imploding television tubes, animals and so on for his Fairlight, Gabriel eventually decided to get in real humans to play music for the finishing touches to his album.

The lesson to be learnt from this is that it is not just a case of dipping into one's pocket once and for all for a fancy piece of kit. There is also another problem – that with all the time it takes to program the machine to get acceptable results, the pocket is not being replenished.

Digitised sound is something like a newsprint photograph – if you look very closely at the ink, you can see that the whole picture is made up of many fine dots

Despite this, the Fairlight and other digital synthesisers still reproduce sounds more accurately than conventional analogue synthesisers by using a technique called sampling. A sound effect is captured, let us say with a microphone, then digitised and stored into memory.

Digitised sound is something like a newsprint photograph – if you look very closely at the ink, you can see that the whole picture is made up of many fine dots, whereas if you look at the (analogue) original, you will see that the tones are made up of solid black areas which gradually fade to lighter shades. Note that the pigment is unbroken.

Analogue V Digital

Digits are easier to store and process in digital computers. Analogue computers are a thing of the past and analogue synthesisers may go the same way. Although many use digital techniques to store sound settings, their primary sound source, the voltage controlled oscillator ▷

A MUSICIAN'S VIEW

Rick Wakeman is well-known for his use of synthesisers and strong opinions on their use.

So what do the top musicians think of computer music? Who better to ask than Rick Wakeman, one of the early pioneers of synthesised music. No need to delve into his background as it has already been exhaustively documented in the past in numerous press and television reports although he has been a little out of the limelight lately.

He still looks pretty much the same though – long, flowing, golden locks. Not quite hippy, but his dress reflects that era (denims, cowboy boots, and so on).

As his hands glide over various keyboards, one is left in no doubt that he has not lost his touch. He makes one point clear: he is no great lover of sequencers.

"I remember sitting with Bob Moog for one and a half hours and not remembering a thing except his name," he quips. Does he see the day when keyboard players will have just the one keyboard with a microcomputer alongside?

"A keyboard is like a typewriter. You can have the biggest computer around but one terminal won't run it," he says.

This is not a good start and he knows it. I must have been wearing a very puzzled or sceptical look. This puts him on his guard. "Am I making sense?" he asks with embarrassed hesitation.

"Not quite," I reply, equally embarrassed. Fortunately my response appears to sharpen his wits.

"You can only physically play two keyboards at once. That is the practical limit," he explains. "But musicians will still want to choose from a number of different keyboards while they play for some time to come. They still want the flexibility."

"If you pre-program a synthesiser, it doesn't allow you to change sounds according to your environment, the audience, the mood and so on."

But surely programmability allows people to compose and create music without having to be performers themselves. "The 60s and 70s produced musicians which were not the most intelligent in the world. Now they are expected to know computers."

"When I lived in Switzerland I was involved with Warner Bros, the owners of Atari, and this allowed me to learn to program in BASIC. Unfortunately, nobody has turned BASIC around. It is still limited and the same applies to computer music."

"The Synclavier is a great instrument but you can only get out of it what you put in. Chips have done as much damage as good in that they cheat people into thinking that anyone can come off the street and produce music."

This may sound somewhat elitist, but Wakeman is concerned that the technology of music has moved ahead of the musicians themselves. His message to them about the new keyboards is: "Don't let them control you."

"People are saying that the Minimoog is now outdated, but I say it is still ahead of its time because they still don't know all it can do." ○

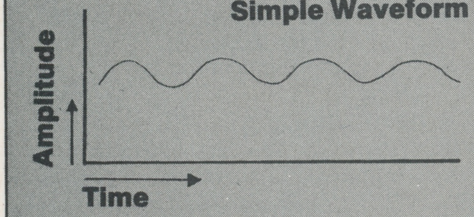
GLOSSARY OF TERMS

Frequency:
The human ear reacts to sound as a result of the eardrum moving in and out at a certain speed. The speed of this in/out movement is called pitch in acoustic terminology and frequency in electronic terminology. The basic measurement of frequency is the Herz, or the number of (in/out) cycles per second which makes up a sound.

The internationally agreed pitch standard is set at 440Hz for the A above middle C. By its very nature, music and sounds follow mathematical patterns and whereas in the past, concert pitch was found to arbitrarily set the sound of A above C at 443Hz, the advent of broadcasting and recording technology dictated the requirement for a more electronically workable reference frequency.

Technical diagrams typically show frequency as a squiggle along a horizontal axis for time and along a vertical axis for amplitude (loudness), known as waveform. A simple sound, generated by an electronic organ for example, will show a constant amplitude as shown in the diagram. More complex sounds are covered in the section on envelope shaping.

Simple Waveform



White Noise:
If you watch an old, well-used film, you will notice from time to time odd little flashes all over the screen. If you inspect the film itself frame-by-frame, you will probably find scratches through which light from the projector lamp will shine through when the film is being shown.

The equivalent effect in the audio medium is called white noise, for example when an old audio tape or a scratched record is being played. In small doses it may be bearable but white noise is a nuisance when it is not wanted. However, in the case of synthesiser music, white noise can give a sound more bite if it is added intentionally. Although white noise may be desirable in synthesisers, what is more fashionable nowadays is something similar called 'pink noise'.

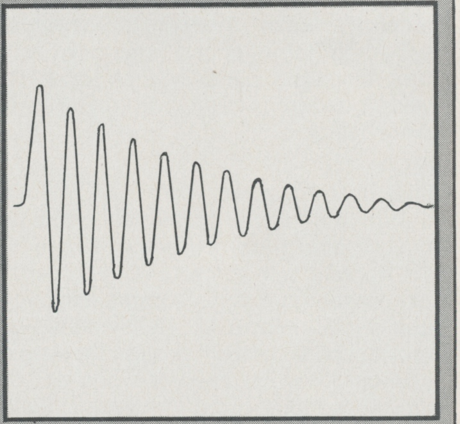
Pink noise is a more controlled and controllable type of noise than the hiss of conventional white noise. It has a more dreamlike quality – a sound something like a locomotive letting off steam. Strictly speaking, white noise in a synthesiser is not really white noise but a random mixture of all the frequencies it can produce, and pink noise just provides more bias towards the bass frequencies.

Envelope Shaping:
A simple sound will have a waveform showing a uniform amplitude. An electronic organ will generate such a waveform for as long as a key is held down. A piano will show a different, more complex waveform. There is a surge in amplitude, followed by a gradual decrease, whether the key is held down or not (see diagram).

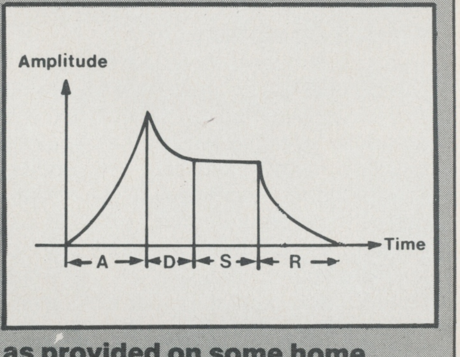
Envelope shaping allows signal amplitudes to be manipulated, typically in four sections in the case of most synthesisers: attack, decay, sustain and release (ADSR). In other words, envelope shaping allows you to determine the changes in volume of a sound over time.

The attack time determines how long it takes the signal to reach peak volume. The decay time determines how long it takes the signal to come down from peak volume to sustain volume.

Sustain is a level rather than a time setting in the ADSR envelope and expressed as a percentage of peak volume. Once the signal has been processed through the attack and delay sections of the envelope, it will remain at that sustain volume for as long as the key is held down.



from a typical instrument



as provided on some home micros

The final setting, release, is the time it takes for the sound to die away when the key is released. The A,D and R settings should be independently adjustable from around 2 milliseconds to 10 seconds. ○

▷ (VCO), is still an analogue device. The sound is then further shaped by means of 'subtractive synthesis' in pretty much the same way as a sculptor would carve a statue out of a solid block of marble.

By contrast, digital or 'additive synthesis' builds up a sound in the same way as an architect would build up, let's say a church, on top of a basic structure or foundation. With conventional subtractive synthesis, the musician starts with a square wave (or sawtooth or triangular wave) and hones it down by means of other electronic circuits such as voltage controlled filters (VCF).

Some additive synthesis can be provided if more than once VCO is used but this brings with it problems of keeping them calibrated, that is, in tune with each other. This is why polyphonic synthesisers – those which allow the performer to play a number of notes simultaneously by striking the corresponding keys, as in a piano for instance – are expensive, particularly if each voice has more than one VCO.

With digital synthesis, the number of 'oscillators' is not as restricted and digits remain digits so they stay in tune. Therefore the musician can start with a basic signal waveform like a sine wave and add harmonics and other things to it.

Valves and Trannies
Before we delve further into the nitty-gritty of digital synthesis, we should not dismiss analogue synthesis too quickly as a thing of the past. When transistors came in everyone thought that would be the end of the valve amplifier, but the majority of guitarists still prefer valve amps, even though they can use a battery of effects pedals with a tranny amp to get an acceptable sound. This is why a major manufacturer such as Roland is in no hurry to get into digital synthesis. You can get weird and wonderful effects with digital synthesis but 'digital noise' is a problem which is hard to lick.

Sampled sounds which have been digitised into memory are not, strictly speaking, synthesised sounds. They have not been built up from basics. They are numerical representations of real-life analogue sounds. This means that sampling keyboards (and in this category we include machines such as the Fairlight, the Emulator, the PPG Waveterm and the Yamaha CE20 which uses pre-set sampled sounds, as well as the Synclavier which provides a sampling option as a secondary function) can use up a lot of memory depending on the length of the sound sample.

"Sampling is a dead-end," says Bradley Naples, marketing and sales director of New England Digital, the company which manufacturers the Synclavier. He argues that once a sound has been sampled and digitised, it is better to extract its parameters and resynthesise it, because then it can be manipulated electronically and played back on other keys more easily. ▷

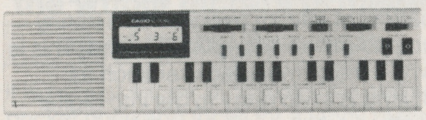
▷ Lifelike Sound

This of course, means that the musician has to live with a less than lifelike sound, but it is almost impossible to change the pitch of a sampled sound and expect it to sound like the original instrument playing the corresponding pitch. Take a tenor saxophone, for example. If you take a sample at one pitch and then play up the keyboard, is the resulting sound that of a tenor sax playing at the top of its range, or an alto sax at the middle of its range, or neither?

A piano is even more of a headache because the envelope shapes are so different for each key. A note at the top will sound like a short 'plink' whereas a note at the bottom will sound more like a 'don-n-ng' (longer duration – geddit?). With sampling, you would need to take a sample for just about every key, and with synthesis, the amount of electronic manipulation and numbercrunching would approach horrendous proportions.

The conclusion that must be drawn is that the way of the future for synthesisers is not to try to imitate sounds of existing instruments but to exploit the sound capabilities of the synthesisers themselves in much the same ways as the early Rock 'n' Roll heroes learnt to exploit electric guitars as instruments in their own right rather than as imitators of acoustic guitars.

Trio had more success on the charts last year with the hit song 'Da Da Da' using a Casiotone VL1 which you can now pick up for around £30, than Peter Gabriel did with his equipment costing tens of thousands of pounds.



Da Da Da

The German new wave group Trio had more success on the charts last year with the hit song 'Da Da Da' using a Casiotone VL1 which you can now pick up for around £30, than Peter Gabriel did with his equipment costing tens of thousands of pounds. It's creativity that counts after all and although the sounds available on the VL1 are not wonderful, Trio made creative use of the 100-note sequencer facility.

To some extent, sequencers can be regarded as early forerunners to modern computer-based music composition languages. The German synthesiser group Tangerine Dream was one of the first to use sequencers. Its soporific performance at Coventry Cathedral in 1976 was eventually recorded on an album but the television programme of ▷

WHICH PACKAGE?

A variety of both hardware and software add-ons are available to add music to popular micros.

Making music on a micro will almost certainly require a combination of hardware as well as software, so in this section, the term 'package' covers both, instead of the traditional software-only computer industry defination of a package.

Most of these packages run on the Apple II. The reason for this, according to Dr. David Ellis, a leading authority on computer music, is that the Apple's slot-in card facility for hardware makes it very popular for musical applications.

ZonX

A programmable sound generator with its own internal speaker and amplifier which plugs in to the edge connector on the back of the Sinclair ZX81 or Spectrum. Various sound effects like space invaders, explosions, and so on, in addition to musical capability. A General Instruments IC contains three digital oscillators providing three sound channels with programmable pitch, volume, and envelope control. Available from Bi-Pak in Ware, Herts.

ALF

Like the ZonX above, the ALF MC-16 is a three-voice digital synthesiser module, but comes in the form of a plug-in card for the Apple II, with software which is capable of driving up to three cards (nine voices in total): Musical score is entered as conventional notation through the Apple keyboard with volume variations including crescendos and diminuendos. Each voice can have a different envelope shape and the three audio outputs can be changed to stereo output under program control.

Amdek CompuMusic

This one is bound to be a hit when it is launched in late February or early March. Amdek is planning to sell this through computer stores as well as the traditional musical outlets serviced by Roland, Amdek's parent company. The hardware consists of a control box 33 cm wide x 11 cm high x 19 cm deep with control knobs for eight sound channels, each of which have CV and gate outputs to drive external synths and drum machines although it has its own limited sound generation capability. The system is connected to a personal computer by means of a cable on the end of which is a 'personality module' (an interface board).

The system was originally designed for a 48K Apple II with a disk drive, although a Sharp MZ80K version is also available and Amdek is waiting to get its hands on a Sinclair MicroDrive to see whether a Spectrum can drive the CompuMusic. The software basically provides a tabular screen-based composer and editor and Amdek has capitalised well on Roland's MicroComposer design features. Channel 1 is for the melody, channel 2 for the bass line, and channels 3 to 6 for chord configurations/sequences. The music covers nine and a half octaves. Channels 7 and 8 are for triggering other external devices like drum machines.

There are two additional soft channels, 0 and 9, driving the CompuMusic's own internal drum rhythms, which include bass and snare drum, high and low toms, open/closed hi-hat and crash cymbal. Once a piece of music has been composed, it can be scored out on a plotter, and Amdek offers one for £600. The CompuMusic package is expected to sell for around £450.

Alpha Syntauri

As this system costs more than the Apple II computer which drives it, this may be stretching the definition of a package a little and in this case it is more a musical instrument than a computer-based musical package. The total package including software costs around £1,300. Apple co-founder Steve Wozniak happens to be chairman of Syntauri Corp so the company's future is assured as far as research and development in computer technology is concerned.

The Alpha Syntauri uses a four- or five-octave velocity sensitive keyboard for eight-voice polyphonic performance with two independent digital oscillators per voice. The primary sound source comes from the Mountain Hardware plug-in card which computes complex waveforms created by using a method called 'Fourier synthesis' or additive synthesis. A curious feature allows octaves to be split up into 32 parts – the normal number of notes in an octave is 12.

A program called MusicMaster for ear training and basic sight reading skills covers topics such as intervals, scales and triads. Advanced topics include melodic dictation and counterpoint. Another program called Metarak provides a 16-track digital recording system. Keyboard performances may be recorded in real-time and musical score of up to 16 parts can then be dumped to a matrix printer/plotter such as the Microline. The system could do with a composition language and a rhythm generator for drum sounds, but Terry Lloyd, proprietor of a Ladbroke Grove-based outfit called Computer Music Studios, distributors of the Alpha Syntauri, assures me that both features will soon be available. ○

THE CASIO 701

The Casiotone 701 has been singled out for mention because it illustrates how computation has been incorporated in a very cheap instrument. Weighing in at £555 recommended retail price, it is currently the top-of-the-range product from the musical instruments division of Casio Electronics.

It must be pointed out at this stage that the sound quality of the 701 is just passable. There are no envelope shaping facilities of the type found on most synthesisers. It is basically a sophisticated consumer organ. The 701 is a 61-key, eight-note polyphonic keyboard covering five octaves.

When the on-switch is thrown, there are numerous other knobs, buttons and switches to get to grips with and the boring prospect of ploughing through the manual will not appeal to many people, so one should first play around a little beforehand, and the controls are cleverly laid out from left to right to help with this.

The first control is called 'Casio Chord' and allows whole chords to be stored – conventional synth sequencers can only store individual notes even with polyphonic sequences. Any chord may be played but the 701 is only intelligent enough to recognise majors, minors, sevenths, minor sevenths, and diminished and augmented chords. This means that any other more fancy chord pattern cannot be stored into memory for automatic playback.

Majors and Minors

Automatic chord computation comes with the second position on the same control. This means that you can press one key and the major chord of that note (or 'tonic' in music theory jargon) will play back as though you had fingered the complete chord. If you want a minor chord, you press the tonic and any key to the right of it – you don't have to find the second interval and dominant – or any two keys to the right of the tonic for sevenths. This facility is only available for majors, minors and sevenths. If more chord structures were to be added by adding an extra key each time, you would run out of fingers, and any way, you would be picking up all the wrong habits because the 701 is basically a teaching machine for conventional keyboard tuition.

The second control, the accompaniment select, synchronises chords with the rhythm controls in the adjacent cluster of switches. First you choose one of 16 rhythms, then you press the start/stop button and the percussion begins. If the accompaniment select is in the first or 'continuous' position and a chord is played, it will be played continuously. A bass pattern matching that chord will play out according to the rhythm selected. In the second position, called 'rhythmic', the chord is syncopated. In other words it sounds as though you're hitting the chord at regular intervals in time with the rhythm when you are in fact holding it down continuously. In the third position, you get the syncopated chord plus an arpeggio of that chord.

Chord Storage

So far, the facilities mentioned are not unique to Casio although they have been combined to better effect than similarly priced keyboards.

At only £555 the Casiotone 701 includes a bar-code reader to input music from paper.

The memory play function on the 701 is Casio's tour-de-force. Chords may be stored into memory from the rhythm section and played back using any rhythm. The chord storage has a capacity of 201 steps – enough for most pieces of music. The melody section has a note storage capacity of 345 steps and a number of correction and editing facilities not available for chord storage.

Memory play works along similar lines to the pianola but instead of rolls of punched paper, semiconductor memory is used, and instead of the keys being depressed as if by an invisible hand, an LED goes on above each key.

Music may also be put into memory by means of a supermarket checkout type bar-code reader. Sadly, this ingenious feature is confined to 'pre-recorded' bar-code music and there are no facilities for generating your own bar-coded music.

The Casiotone 701 is a clever instrument, but once you get the hang of its facilities, you begin to realise the potential for more facilities you wish could be added. Tape storage to and from memory instead of pre-recorded bar-coded music for example. There are batteries which keep what is in memory when the machine is switched off, but when a new piece of music is stored, the old is lost. If you're hot on electronics, you could try interfacing a cassette recorder, though Casio does not recommend. Despite this, the Casiotone 701 is an admirable product for the price. ○

▷ the same event was excruciatingly tedious.

The endless repetition of the same sequence of notes may be all right to listen to when the sounds of those notes are being changed, but as a visual spectacle one could not say with certainty whether the people standing at the keyboards were dead or alive. Still, Tangerine Dream paved the way for a better use of sequencers.

Then, along came multi-channel or multi-tracking sequencers which allowed musicians to store whole chord sequences rather than single-note (monophonic) sequences. The most celebrated case of computer music composition must be the Human League Album 'Dare' released last year, produced by Martin Rushnet with the aid of a four-channel Roland MC4 MicroComposer sequencer driving a Roland Jupiter 4 four-voice polyphonic synthesiser and a Linn Drum computerised drum machine, among other bits of kit.

One more drummer for the dole queue. The problem is that in many cases, the Linn Drum sounds better than most studio engineers can achieve from recording real drum kits.

Polyphonic

Some synths have internal monophonic or polyphonic sequencers, otherwise they need jack plug inputs and outputs for control voltages to set the pitch of the oscillator and gate to set note duration.

This is fine as far as monophonic sequences are concerned. But when it comes to polyphonic sequences, the back panel of the synthesiser can become somewhat overcrowded with jack plug sockets. This is when the fun starts because a more rational interfacing method has to be found and out of the resulting tangle it will be some time before a common interfacing standard is agreed on by all the manufacturers. Some have already begun to go their own way. *(Ed – sounds familiar doesn't it?)*

Oberheim's DSX polyphonic sequencer may be more accurately described as a microprocessor-controlled digital recorder because sequences can be merged into complete compositions to a total capacity of 3,000 or 6,000 notes.

Interfaces

The DSX has a multi-pin interface socket on the back panel for connecting to its OBX-a synthesiser to control its eight voices, as well as eight sets of external Control Voltage and gate jack sockets, but these external sockets do not work unless an OBX-a is plugged in. Synth manufacturers have obviously picked up a few tricks from the computer industry.

As for internal monophonic sequencers, Casio provides an interesting example of one on its CT 1000P. It is in fact a cross between a sequencer and an arpeggiator. Conventional arpeggiators run up, down ▷

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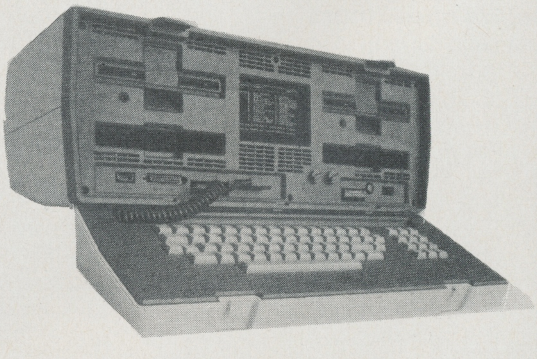

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▷ or up and down individual notes when a chord is held down on the keyboard.

Unfortunately this can be quite restrictive because the arpeggio has to complete its cycle and if, for instance, you are playing on a straight four-four beat, you have to play four arpeggios or a number that divides or multiplies into four. You cannot play parts of an arpeggio, say 3-2-1-3-2-1-3-2 (eight notes) on an arpeggio running down, without the arpeggiator putting in the final 1 and mucking up your timing. With the CT 1000P you key in precisely those numbers in advance and when you then hold down a chord, the arpeggiator will play it as you want it.

With the advent of digital synthesis, micro manufacturers will become increasingly involved in this market. Casio is an example of a computer company moving into musical instruments, while Roland is an example of a musical instruments company moving into computers.

Floppy Disks

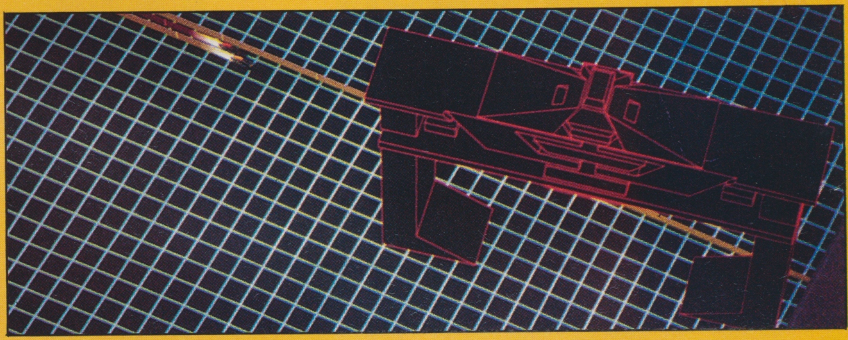
Roland has recently set up a subsidiary called Amdek which plans to launch 3" diameter floppy disk drives into the computer market, as well as a plotter which it claims will sell for around £600. It is currently using this to plot out musical score from its CompuMusic analogue synthesiser controlled by micros like the Apple II and the Sharp MZ80K. The CompuMusic is reviewed separately in this article.

These are exciting times indeed for musicians, particularly those who have found themselves splashing out on analogue hardware to find it superseded by better kit within a year. Will digital synthesis mean that musicians will get protection for their hardware investments because so much is done in software? Computer manufacturers see to it that once their users have made an investment, they keep spending money with them, so why should it be any different with computer music? ○

TRON MUSIC

Walt Disney's latest film TRON has received rave reviews for its stunning graphics. Less well-known is the fact that micro computers were used for music and sound effects.

Sound effects for TRON were catalogued using an Atari 800. The 'Recogniser' (shown about to attack a light cycle) was based on the Goodyear Airship noise.



If one is to be brutally objective, the film TRON offers little to rave about. As far as films go it is merely competent – nothing more. But as far as computer literate (Computerate?) people are concerned, the film is brilliant. They recognise the quality of the computer graphics.

The same can be said for the music. It is all too easy for the lay public to take it all for granted without actually noticing the way in which sounds recorded by the London Philharmonic Orchestra at the Royal Albert Hall subtly blend in with studio recorded synthesiser sounds, all in perfect synchronisation with the visuals.

There again, why should they? It has all been done before with conventional soundtrack recording techniques. But is that all that can be said for computer techniques in soundtrack recording, that they are unobtrusive? (A worthy attribute anyway when you think of it). Actually there is more to it than that.

Visual Chauvinism

The main problem which computers helped to overcome was that of budget restrictions, a serious constraint given of the 'visual chauvinism' of the film industry, according to Michael Fremer, music and sound design supervisor for TRON, a job which gave him overall responsibility for the movie soundtrack.

The major part of the film takes place inside an imaginary electronic world within a computer system, controlled by a corrupt communications conglomerate called Encom, and headed by the unscrupulous company executive, Dillinger, who manages to steal programs written by a more gifted colleague called Flynn, the hero of our story.

Flynn gets trapped by the Master Control Program (no apologies to Burroughs Corp in the credits), originally created by Dillinger as a user-hostile operating system, but now Dillinger's master as it grows in intelligence by stealing programs from outside organisations, including the Pentagon. Flynn is physically flung into the electronic world by Encom's laser, controlled by the MCP's recently acquired laser imaging software facilities, when he tries to penetrate Encom's system to uncover incriminating evidence with which he may expose Dillinger.

Fremer's original plan was to use a traditional orchestra for the real world and electronic music for the computer world. He called in Wendy Carlos, soundtrack composer for film director Stanley Kubrick in the films 'A Clockwork Orange' and 'The Shinning'.

Botch-up

Although the London Philharmonic performed their parts well, someone had botched up the recordings. "The recordings sounded really bad," said Carlos. "Many of the tracks were miked too far away and distorted, probably the result of a bad microphone power supply. Many of the sections I wanted recorded in stereo were recorded in mono."

"I used the synthesiser in three ways. First, I added tracks where synthesiser colours were needed. Second, I doubled lines that I thought were played poorly. Third, I put in lines that had been missed altogether by the orchestra, totally off-mike, or improperly recorded."

Fremer also called in Frank Serafine for sound effect design and sythesis. Together they took a ride in a Goodyear blimp to record sounds which were eventually used for the 'Recognizers' and for Sark's flying 'Carriers'. The inside of Fremer's frost-free refrigerator provided the sound for the 'Solar Sailer'.

"We created effects on the Minimoog, the Prophet-5 and the Fairlight," recalls Fremer. "Originally we planned on driving the Fairlight directly from the SMPTE code (see Glossary), but they didn't have their synchronising software worked out the way we wanted at that time."

Atari Database

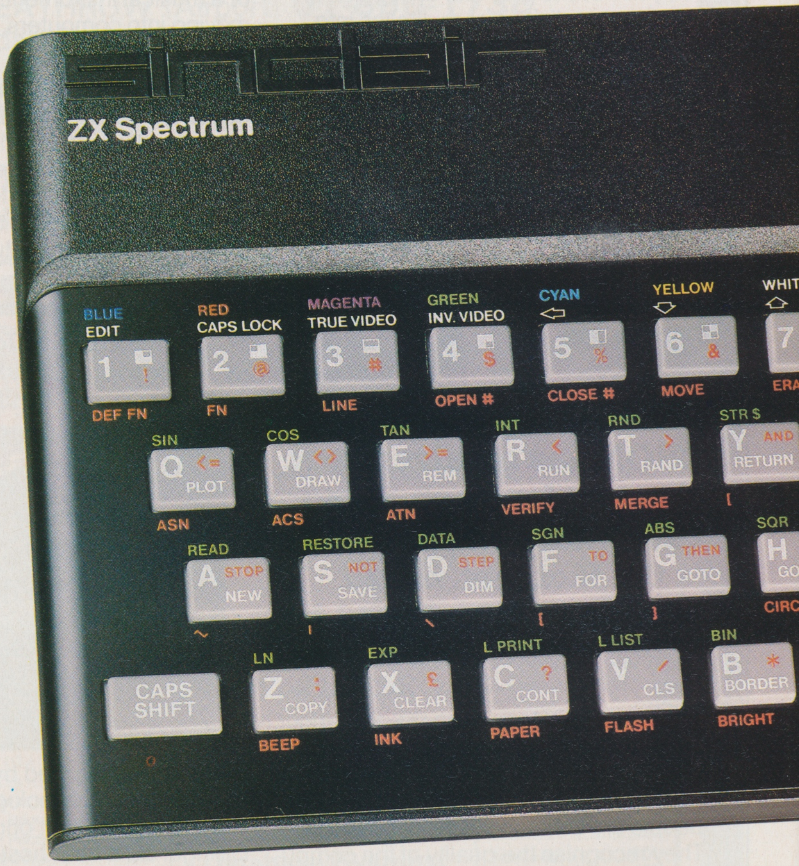
As the effects were recorded, they were entered on File Manager 800, a database management program for the Atari 800 micro sold by Synapse Software. The record for any sound effect, listing its characteristics, source, and location on tape, could be retrieved in under two seconds. Atari also loaned him their sound development software, hitherto used internally by Atari personnel only. Serafine called the entire system 'Electronic Sound Assembly', an assemblage of techniques doing for the creation of sound what word processing does for writing.

The list of credits for TRON is extensive and many other people involved in producing the soundtrack have not been mentioned, but one more piece of kit deserves honourable mention, the Apple II-based Alpha Syntauri synthesiser, covered in more detail under the section on packages for home micros. ○

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!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ZX Spectrum
BLUE EDIT 1 ! DEF FN
RED CAPS LOCK 2 @ FN
MAGENTA TRUE VIDEO 3 # LINE
GREEN INV. VIDEO 4 $ OPEN #
CYAN ⇦ 5 % CLOSE #
YELLOW ⇩ 6 & MOVE
WHIT ⇧ 7 ERA
SIN Q <= PLOT ASN
COS W <> DRAW ACS
TAN E >= REM ATN
INT R < RUN VERIFY
RND T > RAND MERGE
STR $ Y AND RETURN [
READ A STOP NEW ~
RESTORE S NOT SAVE |
DATA D STEP DIM \
SGN F TO FOR {
ABS G THEN GOTO }
SQR H GO CIRC
CAPS SHIFT
LN Z : COPY BEEP
EXP X £ CLEAR INK
L PRINT C ? CONT PAPER
L LIST V / CLS FLASH
BIN B * BORDER BRIGHT

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

trum

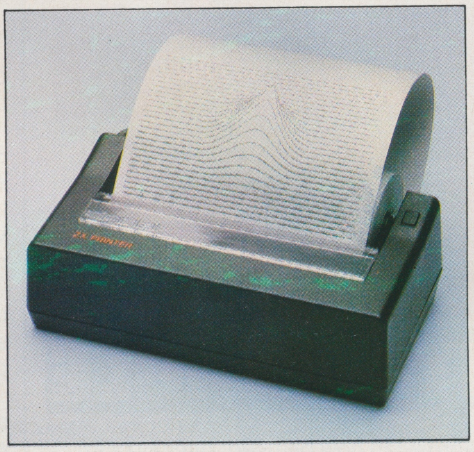
WHITE
GRAPHICS
BLACK
DELETE
7
8
9
0
ERASE
POINT
CAT
FORMAT
CODE
PEEK
TAB
STR $
Y
AND
RETURN
U
OR
IF
I
AT
INPUT
O
POKE
P
PRINT
IN
OUT
SQR
VAL
LEN
USR
H
J
LOAD
K
LIST
L
LET
ENTER
CIRCLE
VAL $
SCREEN $
ATTR
BIN
PI
B
BORDER
N
NEXT
M
PAUSE
SYMBOL SHIFT
BREAK
SPACE
BRIGHT
INVERSE

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.

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ZX Microdrive
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ZX Spectrum software on cassettes – available now

The Spectrum software library is growing every day. Subjects include games, education, and business/household management. Flight Simulation...Chess...Planetoids...History...Inventions...VU-CALC...VU-3D...Club Record Controller...there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

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Sinclair Research Ltd, Stanhope Road,
Camberley, Surrey GU15 3PS.
Tel: Camberley (0276) 685311.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

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	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
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With over a million units installed, the Commodore VIC-20 is now the world's most popular home computer. Its typewriter keyboard and colour graphics make it ideal for the beginner. It's horribly unfriendly BASIC does not. Following the enormous success of their series 'Enhancing PET BASIC', we commissioned *Dave Barrett* and *Dave Wardill* to develop a new set of easy-to-use commands, thereby...

MAKING VIC INTELLIGIBLE

In a lot of ways, the VIC was an excellent addition to the British computer market. It was cheap, it used many existing PET programs, it had quite a good keyboard, and it used colour.

However, as it had been rushed onto the market, it had one or two weaknesses, which were mercilessly exposed when compared with the Sinclair Spectrum and the BBC machines.

For example, the Spectrum uses nice friendly words like INK, and PAPER to set up its screen colours. The VIC uses rather less friendly instructions such as

POKE 36879,4

to do the same sort of jobs.

The BBC machine has a set of FUNCTION keys, with reasonably clear instructions on how to set them up and use them. The VIC also has a set of FUNCTION keys – but nowhere does it tell you in the handbook how to use them.

At *MicroComputer Printout's* request, we set about writing a program which would remedy these defects. We had already produced a set of alterations for the PET which expanded it's vocabulary to include some desperately needed new words, as the VIC used very much the same codes in ROM, it seemed a straight-forward project.

We decided that the new words we were to add had to be usable either as direct commands, or as program statements. In other words, they had to be fully integrated into the VIC system, without affecting the running of any standard program on the VIC.

This proved to be possible, and these words can now be used, directly or in programs, with no complications.

PAPER and INK

These simple words replace the Commodore monstrosity

POKE 36879,7

The word PAPER is used with two numbers, each representing a colour. For example, PAPER 5,3 would set the centre part of the screen to colour 5 and the border to colour 3.

Each number corresponds to the number of the key on which the colour is printed on the VIC keyboard, so it is extremely simple to use this word in a program. Just look at the colours on the keyboard to see which numbers to use.

The word INK is equally simple. INK 6 will turn all the characters on the screen to colour 6. The normal setup position of the VIC is

PAPER 4,2
INK 7

There seems to be a growing number of VIC enthusiasts who are learning Machine Code, and who have a VIC assembler or monitor. For their sake, we have included these assembler listings which we used when writing these routines. The labels they use make them quite readable, and we hope you find them illuminating. When we were learning Machine Code, we felt a great need for simply explained examples of real code, and listings like these would have been very useful.

Incidentally, if you are beginning to take an interst in this type of programming, why not refer back to the articles by Mike Gross-Niclaus in last year's *MicroComputer Printout*. The PET and the VIC use identical codes (although some addresses are different), and his articles, read with our codes, should be very helpful indeed to you.

SOUND and VOLUME

Once again, the VIC is exasperating in its use of sound. The fact that sound is implemented is delightful; the fact that it has to be accessed with code like

POKE 36874,129:POKE36875,215:
POKE 36876,251:POKE36878,5

is lamentable.

Our program replaces all this with a much more pleasant set of commands

SOUND 129,215,251,10
VOLUME 10

The three numbers in the SOUND command represent the note to be produced by the three voices in the VIC. In order, they are the Baritone, Alto and Soprano voices. The numbers to be assigned to each voice corresponding to each musical note are given in the VIC handbook. They have to lie in the range between 129 and 255.

The forth number is the duration. It is the number of 'jiffies', or sixtieths of a second, for which the note is to be played.

The other word controlling the VIC's sound registers is VOLUME. This is set at a value from 0 (off) to 15 (full volume).

In both these words, the numbers can be represented by variables. Different effects can be generated simply under software control by using methods like this.

```
100 VOLUME 15
110 FOR X=129 TO 255
120 SOUND 0,0,X,3
130 NEXT I
140 VOLUME 0
```

This article supplies you with seven FREE commands to add to your VIC-20:

PAPER
INK
VOLUME
SOUND
VDU
FUNCTION
SPARE

You don't need any knowledge of programming to get these commands running.

```
;********************************
;*                              *
;*   PAPER                      *
;*                              *
;*   PAPER CENTER, BORDER       *
;*   PAPER 4,2                  *
;*                              *
;********************************
;
   PAPER   JSR BYTIN
           TXA
           SEC
           SBC £$01
           ASL A
           ASL A
           ASL A
           ASL A
           STA $57
           JSR COMMA
           JSR BYTIN
           TXA
           CLC
           ADC £$07
           AND £$0F
           ADC $57
           STA $900F
           RTS
   PEN     JSR BYTIN
           TXA
           SEC
           SBC £$01
           AND £$0F
           LDY £$00
   FONT    STA $9600,Y
           STA $9700,Y
           INY
           BNE FONT
           STA $286
           RTS
```

```
                        ;*************************************
                        ;*                                   *
                        ;*          FUNCTION KEYS            *
                        ;*                                   *
                        ;*                                   *
                        ;*************************************

POINTR .BYTE 00
INTVEC LDA £$00
       STA POINTR
       LDA 653
       BEQ NOSHFT
       CMP £2
       BCS EXIT2
       LDA £32
       STA POINTR
NOSHFT LDA 203
       LDX £03
CHKAG  CMP KEYLST,X
       BEQ REPEAT
       DEX
       BPL CHKAG
       LDA £$01
       STA $FB
EXIT2  JMP $EABF
REPEAT LDA $FB
       BEQ EXIT2
       LDA £$00
       STA $FB
GOT    LDA £8
       STA 198
       TXA
       ASL A
       ASL A
       ASL A
       CLC
       ADC POINTR ▷
```

```
▷       .BYTE 'INK',0,0,0,0,0
        .BYTE 'LIST',13,0,0,0
        .BYTE 'RUN',13,0,0,0,0
        .BYTE 'NEW',13,0,0,0,0
        .BYTE 'CLR',13,0,0,0,0
        .BYTE 00
ORDER1  .BYTE 0,4,1,5,2,6,3,7
FUNC    CMP £'9
        BCC OKFUNC
NOFUNC  JMP ERROR
OKFUNC  SEC
        SBC £'1
        BMI NOFUNC
        TAX
        LDA ORDER1,X
        ASL A
        ASL A
        ASL A
        STA $FC
        JSR CHRGET
        JSR COMMA
        JSR $CD9E
        JSR DISCRD
        LDA $0D
        BEQ NOFUNC
        LDY $19       ;LENGTH OF INPUT STRING
        CPY £09
        BCS NOFUNC     ;STRING TOO LONG
        LDY £00
        LDX $FC
STORE   LDA ($1A),Y
        STA LOWKEY,X
        INX
        INY
        CPY $19
        BCC STORE
CHKEY CPY £08
        BCC ZERO
        RTS
ZERO    LDA £00
        STA LOWKEY,Y
        TAY
        LDX £08
        STX 198
        LDX £0
KEYOUT LDA LOWKEY,Y
        STA $0277,X
        INY
        INX
        CPX  £08
        BCC KEYOUT
        BCS EXIT2
KEYLST .BYTE 39,47,55,63
LOWKEY .BYTE 'VOLUME',0,0
        .BYTE 'SOUND',0,0,0
        .BYTE 'PAPER',0,0,0
```

```
;****************************
;*                          *
;*   SOUND ROUTINES FOLLOW  *
;*                          *
;****************************
;
;****************************
;*                          *
;*     VOLUME               *
;*     VOLUME VAR (1-15)    *
;*                          *
;****************************
;
VOL     JSR BYTIN
        TXA
        AND £$0F
        STA VOLE
 ;      RTS
 ;
;****************************
;*                          *
;* SOUND USES THE SYNTAX    *
;*                          *
;* SOUND BASS, ALTO,        *
;* SOPRANO, DURATION        *
;*                          *
;* THE FIRST THREE PARAMETERS
;* ARE NOTES IN THE RANGE   *
;* 128 - 255                *
;*                          *
;* DURATION IS IN THE RANGE *
;* 0-255 AND IS IN JIFFIES  *
;*                          *
;****************************
;                         ▷
;
```

```
▷SOUND  JSR BYTIN
        STX $900C
        JSR COMMA
        JSR BYTIN
        STX $900B
        JSR COMMA
        JSR BYTIN
        STX $900A
        JSR COMMA
        JSR BYTIN
        TXA
;
        BEQ EXIT
PART    LDX £17
PART1   LDY £199




PART2   DEY
        BNE PART2
        STA $FC
        JSR TSTSTP
        BEQ STOP
        LDA $FC
        DEX
        BNE PART1
        SEC
        SBC £$01
        BNE PART
EXIT    RTS
STOP    STA VOLE
        JMP BRKVEC
```

```
        ;****************************
        ;*                          *
        ;*  VIC VDU COMMAND         *
        ;*                          *
        ;*  SYNTAX VDU X,Y          *
        ;*                          *
        ;*                          *
        ;*                          *
        ;****************************
VDU     JSR BYTIN          ;GET BYTE INTO X REG
        TXA
        CMP £22
        BCC VDUOK
VDUERR  JMP ERROR
VDUOK   PHA
        JSR COMMA          ;HANDLE COMMA BETWEEN VALUES
        JSR BYTIN
        TXA
        CMP £22
        BCS VDUERR
        TAY
        PLA
        TAX
        JMP $FFF0          ;JUMP TO KERNAL ROUTINE
```

These source code assembler listings are provided for readers who are familiar with 6502 Assembly Language and are interested in seeing how the commands were written. If you would like to learn Assembly Language, *MicroComputer Printout* ran a complete beginners course in the July 1981 to December 1981 issues. Individual back issues are available price £1.25 inc. P&P, or we'll send you the complete Assembler course for £5.00

If the running of this type of program is interrupted by the 'STOP' key, the volume is automatically set to zero. This prevents the mindless shriek which usually ensues under these circumstances, but it also means that you will have to set the volume back to an audible value before you can hear anything again.

Once again, we have included the assembler listing for VIC machine code buffs.

VDU

One of the routines we found most useful on the PET was the VDU command, which we wrote up for PET users in the January issue.

It works equally well on the VIC, using this syntax

VDU 10,12

will place the cursor 10 lines down and 12 columns across the screen.

VDU 10,12:PRINT"Hello"

The program does not allow you to specify the bottom line of the paper, as scrolling would occur if you did.

The origin (0,0) is in the top left of the screen.

This routine can also be seen as an Assembler program.

Function Keys

The BBC machine has a set of FUNCTION keys, and it's handbook give quite specific information on how to use them. The VIC also has a set, but we doubt whether many owners know what to do with them. To help with this problem, we have made it possible for the FUNCTION keys to generate commands, and have provided the facility for owners to put their own commands on to the key of their choice.

Our keys are set up like this

KEY NO	COMMAND
1	VOLUME
3	SOUND
5	PAPER
7	INK

There is no 'RETURN' following these commands, so you can enter the values which you choose to go with these words.

For example, to set the sound output to its maximum, you would press Function key number 1. The word 'VOLUME' would appear on the screen. You would enter '15' and press return. This is a lot quicker than POKE 36878,15, isn't it?

The other four keys, which need 'SHIFT' to be pressed to use them, are set up as follows

KEY NO	COMMAND
2	LIST
4	RUN
6	NEW
8	CLR

However, each of these keys also includes the return key-press, and so the command will work immediately.

For example, in order to list a program, simply press Function key 2 and a listing will appear at once.

Perhaps your choice of words would not be the same as ours, and you would like to change one or more of the keys. The command word 'FUNCTION' will let you do this.

FUNCTION 1, "GOTO"

will cause 'GOTO' to appear when key 1 is pressed.

If the 'RETURN' key-press is also required, then use '+CHR$(13)' at the end of your new instruction. For example, to find out how many bytes are free, with one key-press, you could enter

FUNCTION 1,"?FRE(0)" +CHR$(13)

When you press function key 1, this will appear on the screen

?FRE(0)
1432

where the '1432' is the number of bytes free. The actual value you get will depend on how big your machine is, and how much program you have in it at the time.

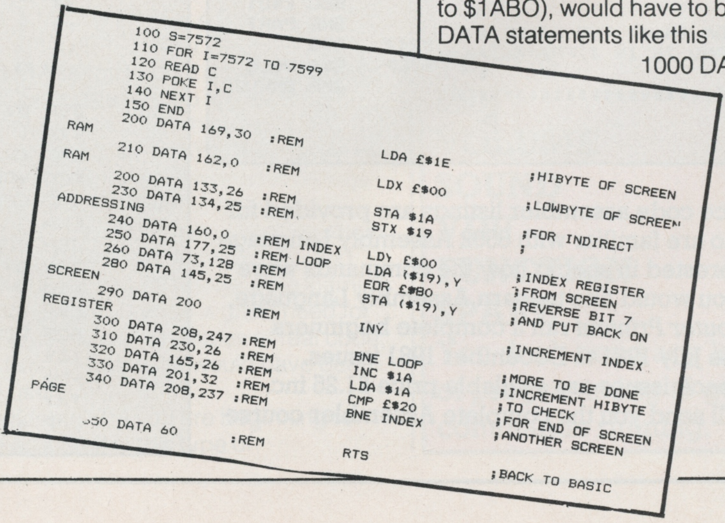
There are very few restrictions on the use of this word. However, because of the relatively small memory space in the VIC, we have kept the maximum length of the word which can be generated by the function keys to eight bytes. This could be longer, but space is at such a premium that we decided to be as economical as possible.

SPARE

While we were on, providing words which could be used as direct commands or in BASIC, we decided that it would be a good idea to put in an extra word which could be used for any desired piece of machine code which you might want to include.

If the word 'SPARE' is used when our program has been loaded, nothing seems to happen. This is because the only piece of code there at the moment is 'RTS', which returns control to BASIC. However, if a piece of machine code is put into memory from location 7572 onwards, and 'SPARE' is used, then the machine code will be carried out at once.

When our full program is loaded and working satisfactorily, this can be tested by entering this simple 'FLASH' routine.



```
        100 S=7572
        110 FOR I=7572 TO 7599
        120 READ C
        130 POKE I,C
        140 NEXT I
        150 END
        200 DATA 169,30   :REM
RAM
        210 DATA 162,0    :REM           LDA £$1E
RAM
        200 DATA 133,26   :REM           LDX £$00          ;HIBYTE OF SCREEN
        230 DATA 134,25   :REM
ADDRESSING                               STA $1A           ;LOWBYTE OF SCREEN
                                         STX $19
        240 DATA 160,0    :REM INDEX                       ;FOR INDIRECT
        250 DATA 177,25   :REM LOOP                        ;
        260 DATA 73,128   :REM           LDY £$00
        280 DATA 145,25   :REM           LDA ($19),Y
SCREEN                                   EOR £$80          ;INDEX REGISTER
        290 DATA 200                     STA ($19),Y       ;FROM SCREEN
REGISTER                  :REM                             ;REVERSE BIT 7
        300 DATA 208,247  :REM           INY               ;AND PUT BACK ON
        310 DATA 230,26   :REM
        320 DATA 165,26   :REM           BNE LOOP          ;INCREMENT INDEX
        330 DATA 201,32   :REM           INC $1A
        340 DATA 208,237  :REM           LDA $1A           ;MORE TO BE DONE
PAGE                                     CMP £$20          ;INCREMENT HIBYTE
                                         BNE INDEX         ;TO CHECK
        350 DATA 60                                        ;FOR END OF SCREEN
                          :REM                             ;ANOTHER SCREEN
                                         RTS
                                                           ;BACK TO BASIC
```

Incidentally, you don't need to bother with all the REM statements. Everything after the colon in the DATA statements is simply an explanation of what each piece of code does.

To make the routine work, all that you have to do is to type 'SPARE'. The screen will flash into reverse. Type 'SPARE' again to return it to normal.

If you have found a favourite piece of machine code in a magazine, or you have written one yourself, it can now be executed, directly or in a program simply by using one simple word, as long as it is loaded into the right place in memory – starting at 7572.

LOADING THE PROGRAM

There are three ways of loading the program into a VIC machine. The first is if you have a monitor like VIC-MON, turn it on and type

.M 1ABO,1CBO

This will produce some lines showing the memory contents from 1ABO onwards. Call up a few lines at a time, and overwrite what appears with our HEX listing, until both are identical. Remember to press 'RETURN' at the end of each line. It may be necessary to call up a few lines at a time, so that it can all be fitted onto the screen.

When this has been done, save the result like this, before running the program. (It might crash if you have made any typing errors, and you would have to switch off and lose all your hard work).

.S "DAVES PROG",01,1ABO,1BDA

The message 'PRESS PLAY & RECORD' will appear as if you were saving a BASIC program. Follow the instruction, and when the saving is complete, return to BASIC by pressing X and the 'RETURN'.

If you don't have a monitor, or don't fancy this method, use the DATA LOADER programs at the end of this article – which you will need to type in and save on tape.

When this has been done, load the first program and run it – then the second, then the third.

Why three programs, we hear you ask? Well, in order to enter a single byte of machine code in this way, it takes four or five bytes of BASIC program. These three bytes of code 4C BO 1A, (which are machine code meaning in fact JUMP to $1ABO), would have to be put in DATA statements like this

1000 DATA 76,176,26

▷

```
.:  1AB0 53 4F 55 4E C4 56 4F 4C
.:  1AB8 55 4D C5 46 55 4E 43 54
.:  1AC0 49 4F CE 50 41 50 45 D2
.:  1AC8 49 4E CB 56 44 D5 53 50
.:  1AD0 41 52 C5 00 1A 1C 10 1C
.:  1AD8 F7 1C 3F 1D 5E 1D 76 1D
.:  1AE0 93 1D 78 A0 5C A2 1C 8C
.:  1AE8 14 03 8E 15 03 58 A6 7A
.:  1AF0 A0 04 84 0F BD 00 02 10
.:  1AF8 07 C9 FF F0 3E E8 D0 F4
.:  1B00 C9 20 F0 37 85 08 C9 22
.:  1B08 F0 56 24 0F 70 2D C9 3F
.:  1B10 D0 04 A9 99 D0 25 C9 30
.:  1B18 90 04 C9 3C 90 1D 84 71
.:  1B20 A0 00 84 0B 88 86 7A CA
.:  1B28 C8 E8 BD 00 02 38 F9 9E
.:  1B30 C0 F0 F5 C9 80 D0 30 05
.:  1B38 0B A4 71 E8 C8 99 FB 01
.:  1B40 B9 FB 01 F0 59 38 E9 3A
.:  1B48 F0 04 C9 49 D0 02 85 0F
.:  1B50 38 E9 55 D0 9F 85 08 BD
.:  1B58 00 02 F0 DF C5 08 F0 DB
.:  1B60 C8 99 FB 01 E8 D0 F0 A6
.:  1B68 7A E6 0B C8 B9 9D C0 10
.:  1B70 FA B9 9E C0 D0 B4 A0 FF
.:  1B78 CA C8 E8 BD 00 02 38 F9
.:  1B80 B0 1A F0 F5 C9 80 D0 02
.:  1B88 F0 AD A6 7A E6 0B C8 B9
.:  1B90 AF 1A 10 FA B9 B0 1A D0
.:  1B98 E2 BD 00 02 10 9B 4C 09
.:  1BA0 C6 10 42 C9 FF F0 3E 24
.:  1BA8 0F 30 3A AA 84 49 C9 CC
.:  1BB0 B0 0A A0 C0 84 23 A0 9E
.:  1BB8 84 22 D0 0B E9 4C AA A0
.:  1BC0 1A 84 23 A0 B0 84 22 A0
.:  1BC8 00 0A F0 10 CA 10 0C E6
.:  1BD0 22 D0 02 E6 23 B1 22 10
.:  1BD8 F6 30 F1 C8 B1 22 30 08
.:  1BE0 20 47 CB D0 F6 4C F3 C6
.:  1BE8 4C EF C6 20 73 00 C9 CC
.:  1BF0 90 19 C9 D3 46 30 20 39
.:  1BF8 30 20 31 39 20 43 39 20
.:  1C00 44 13 FF 2E 3A 20 20 31
.:  1C08 42 46 30 20 39 30 20 31
.:  1C10 39 20 43 39 20 12 FF 33
.:  1C18 01 FF 44 01 FF 2E 3A 20
.:  1C20 20 31 42 46 30 20 39 30
.:  1C28 20 31 39 20 43 39 11 FF
.:  1C30 2E 3A 20 20 31 42 46 30
.:  1C38 20 39 30 20 31 39 20 43
.:  1C40 10 FF 2E 3A 20 20 31 42
.:  1C48 46 30 20 39 30 20 31 39
.:  1C50 20 0F FF 39 01 FF 43 01
.:  1C58 FF 2E 3A 20 20 31 42 46
.:  1C60 30 20 39 30 20 31 39 0E
.:  1C68 FF 2E 3A 20 20 31 42 46
```

```
.:  1C70 30 20 39 30 20 31 0D FF
.:  1C78 2E 3A 20 20 31 42 46 30
.:  1C80 20 39 30 20 0C FF 39 01
.:  1C88 FF 31 01 FF 2E 3A 20 20
.:  1C90 31 42 46 30 20 39 30 0B
.:  1C98 FF 2E 3A 20 20 31 42 46
.:  1CA0 30 20 39 0A FF 2E 3A 20
.:  1CA8 20 31 42 46 30 20 09 FF
.:  1CB0 30 01 FF 39 01 FF 2E 3A
.:  1CB8 20 20 31 42 46 30 08 FF
.:  1CC0 2E 3A 20 20 31 42 46 07
.:  1CC8 FF 30 01 FF 46 01 FF 2E
.:  1CD0 3A 20 20 31 42 06 FF 2E
.:  1CD8 3A 20 20 31 05 FF 42 01
.:  1CE0 FF 31 01 FF 2E 3A 20 20
.:  1CE8 31 42 45 38 20 34 43 20
.:  1CF0 45 46 20 43 36 20 32 30
.:  1CF8 20 37 33 20 30 30 20 43
.:  1D00 39 20 43 43 20 FF 2E 3A
.:  1D08 20 20 31 42 45 38 20 34
.:  1D10 43 20 45 46 20 43 36 20
.:  1D18 32 30 20 37 33 20 30 30
.:  1D20 20 43 39 20 43 1F FF 2E
.:  1D28 3A 20 20 31 42 45 38 20
.:  1D30 34 43 20 45 46 20 43 36
.:  1D38 20 32 30 20 37 33 20 30
.:  1D40 30 20 43 39 20 1E FF 43
.:  1D48 01 FF 43 01 FF 2E 3A 20
.:  1D50 20 31 42 45 38 20 34 43
.:  1D58 20 45 46 20 43 36 20 32
.:  1D60 30 20 37 33 20 30 30 20
.:  1D68 43 39 1D FF 2E 3A 20 46
.:  1D70 46 20 32 45 20 33 41 20
.:  1D78 32 30 1D FF 2E 3A 20 20
.:  1D80 31 44 36 38 20 34 33 20
.:  1D88 33 39 20 31 44 20 46 46
.:  1D90 2C 32 45 20 33 41 20 32
.:  1D98 1C FF 2E 3A 20 20 31 44
.:  1DA0 36 38 20 34 33 20 33 39
.:  1DA8 20 31 44 20 46 46 20 32
.:  1DB0 45 20 33 41 20 1B FF 30
.:  1DB8 01 FF 32 01 FF 2E 3A 20
```

This is called the Hex dump and is intended for VIC owners with access to a Machine Language Monitor. Hex codes are the fastest way of entering machine code but you have to be very careful not to make any mistakes!

Here are three BASIC loader programs – which can be used by anyone with no knowledge of programming. Just follow the instructions in the text and, hey presto! – seven new commands.

```
800 POKE51,175:POKE52,26:POKE55,175:POKE56,26
810 FOR AD=6832TO7095:READ DA:POKE AD,DA:T=T+DA:NEXT AD
820 IF T<>32429THEN PRINT "ERROR"
6832 DATA 83, 79, 85, 78, 196, 86
6838 DATA 79, 76, 85, 77, 197, 70
6844 DATA 85, 78, 67, 84, 73, 79
6850 DATA 206, 80, 65, 80, 69, 210
6856 DATA 73, 78, 203, 86, 68, 213
6862 DATA 83, 80, 65, 82, 197, 0
6868 DATA 26, 28, 16, 28, 247, 28
6874 DATA 63, 29, 94, 29, 118, 29
6880 DATA 147, 29, 120, 160, 92, 162
6886 DATA 28, 140, 20, 3, 142, 21
6892 DATA 3, 88, 166, 122, 160, 4
6898 DATA 132, 15, 189, 0, 2, 16
6904 DATA 7, 201, 255, 240, 62, 232
6910 DATA 208, 244, 201, 32, 240, 55
6916 DATA 133, 8, 201, 34, 240, 86
6922 DATA 36, 15, 112, 45, 201, 63
6928 DATA 208, 4, 169, 153, 208, 37
6934 DATA 201, 48, 144, 4, 201, 60
6940 DATA 144, 29, 132, 113, 160, 0
6946 DATA 132, 11, 136, 134, 122, 202
6952 DATA 200, 232, 189, 0, 2, 56
6958 DATA 249, 158, 192, 240, 245, 201
6964 DATA 128, 208, 48, 5, 11, 164
6970 DATA 113, 232, 200, 153, 251, 1
6976 DATA 185, 251, 1, 240, 89, 56
6982 DATA 233, 58, 240, 4, 201, 73
6988 DATA 208, 2, 133, 15, 56, 233
6994 DATA 85, 208, 159, 133, 8, 189
7000 DATA 0, 2, 240, 223, 197, 8
7006 DATA 240, 219, 200, 153, 251, 1
7012 DATA 232, 208, 240, 166, 122, 230
7018 DATA 11, 200, 185, 157, 192, 16
7024 DATA 250, 185, 158, 192, 208, 180
7030 DATA 160, 255, 202, 200, 232, 189
7036 DATA 0, 2, 56, 249, 176, 26
7042 DATA 240, 245, 201, 128, 208, 2
7048 DATA 240, 173, 166, 122, 230, 11
7054 DATA 200, 185, 175, 26, 16, 250
7060 DATA 185, 176, 26, 208, 226, 189
7066 DATA 0, 2, 16, 155, 76, 9
7072 DATA 198, 16, 66, 201, 255, 240
7078 DATA 62, 36, 15, 48, 58, 170
7084 DATA 132, 73, 201, 204, 176, 10
7090 DATA 160, 192, 132, 35, 160, 158
```

```
810 FOR AD=7096TO7353:READ DA:POKE AD,DA:T=T+DA:NEXT AD
820 IF T<>31678THEN PRINT "ERROR"
7096 DATA 132, 34, 208, 11, 233, 76
7102 DATA 170, 160, 26, 132, 35, 160
7108 DATA 176, 132, 34, 160, 0, 10
7114 DATA 240, 16, 202, 16, 12, 230
7120 DATA 34, 208, 2, 230, 35, 177
7126 DATA 34, 16, 246, 48, 241, 200
7132 DATA 177, 34, 48, 8, 32, 71
7138 DATA 203, 208, 246, 76, 243, 198
7144 DATA 76, 239, 198, 32, 115, 0
7150 DATA 201, 204, 144, 25, 201, 211
7156 DATA 176, 21, 32, 252, 27, 76
7162 DATA 174, 199, 233, 203, 10, 168
7168 DATA 185, 213, 26, 72, 185, 212
7174 DATA 26, 72, 76, 115, 0, 32
```

▷

```
7180 DATA 121, 0, 76, 231, 199, 32
7186 DATA 158, 215, 138, 41, 15, 141
7192 DATA 14, 144, 96, 32, 158, 215
7198 DATA 142, 12, 144, 32, 253, 206
7204 DATA 32, 158, 215, 142, 11, 144
7210 DATA 32, 253, 206, 32, 158, 215
7216 DATA 142, 10, 144, 32, 253, 206
7222 DATA 32, 158, 215, 138, 240, 24
7228 DATA 162, 17, 160, 199, 136, 208
7234 DATA 253, 133, 252, 32, 225, 255
7240 DATA 240, 11, 165, 252, 202, 208
7246 DATA 239, 56, 233, 1, 208, 232
7252 DATA 96, 141, 14, 144, 76, 44
7258 DATA 200, 0, 169, 0, 141, 91
7264 DATA 28, 173, 141, 2, 240, 9
7270 DATA 201, 2, 176, 21, 169, 32
7276 DATA 141, 91, 28, 165, 203, 162
7282 DATA 3, 221, 171, 28, 240, 10
7288 DATA 202, 16, 248, 169, 1, 133
7294 DATA 251, 76, 191, 234, 165, 251
7300 DATA 240, 249, 169, 0, 133, 251
7306 DATA 169, 8, 133, 198, 138, 10
7312 DATA 10, 10, 24, 109, 91, 28
7318 DATA 168, 162, 8, 134, 198, 162
7324 DATA 0, 185, 175, 28, 157, 119
7330 DATA 2, 200, 232, 224, 8, 144
7336 DATA 244, 176, 212, 39, 47, 55
7342 DATA 63, 86, 79, 76, 85, 77
7348 DATA 69, 0, 0, 83, 79, 85


810 FOR AD=7354TO7605:READ DA:POKE AD,DA:T=T+DA:NEXT AD
820 IF T<>24201THEN PRINT "ERROR"
7354 DATA 78, 68, 0, 0, 0, 80
7360 DATA 65, 80, 69, 82, 0, 0
7366 DATA 0, 73, 78, 75, 0, 0
7372 DATA 0, 0, 0, 76, 73, 83
7378 DATA 84, 13, 0, 0, 0, 82
7384 DATA 85, 78, 13, 0, 0, 0
7390 DATA 0, 78, 69, 87, 13, 0
7396 DATA 0, 0, 0, 67, 76, 82
7402 DATA 13, 0, 0, 0, 0, 0
7408 DATA 0, 4, 1, 5, 2, 6
7414 DATA 3, 7, 201, 57, 144, 3
7420 DATA 76, 8, 207, 56, 233, 49
7426 DATA 48, 248, 170, 189, 240, 28
7432 DATA 10, 10, 10, 133, 252, 32
7438 DATA 115, 0, 32, 253, 206, 32
7444 DATA 158, 205, 32, 163, 214, 165
7450 DATA 13, 240, 223, 164, 25, 192
7456 DATA 9, 176, 217, 160, 0, 166
7462 DATA 252, 177, 26, 157, 175, 28
7468 DATA 232, 200, 196, 25, 144, 245
7474 DATA 192, 8, 144, 1, 96, 169
7480 DATA 0, 157, 175, 28, 232, 200
7486 DATA 208, 242, 32, 158, 215, 138
7492 DATA 56, 233, 1, 10, 10, 10
7498 DATA 10, 133, 87, 32, 253, 206
7504 DATA 32, 158, 215, 138, 24, 105
7510 DATA 7, 41, 15, 101, 87, 141
7516 DATA 15, 144, 96, 32, 158, 215
7522 DATA 138, 56, 233, 1, 41, 15
7528 DATA 160, 0, 153, 0, 150, 153
7534 DATA 0, 151, 200, 208, 247, 141
7540 DATA 134, 2, 96, 32, 158, 215
7546 DATA 138, 201, 22, 144, 3, 76
7552 DATA 8, 207, 72, 32, 253, 206
7558 DATA 32, 158, 215, 138, 201, 22
7564 DATA 176, 241, 168, 104, 170, 76
7570 DATA 240, 255, 96, 162, 5, 189
7576 DATA 175, 29, 157, 4, 3, 202
7582 DATA 16, 247, 120, 169, 28, 160
7588 DATA 92, 141, 21, 3, 140, 20
7594 DATA 3, 88, 76, 116, 196, 226
7600 DATA 26, 161, 27, 235, 27, 170
7606 DATA 170, 170, 170, 170, 170, 170
```

and this line takes up 14 bytes in BASIC. Therefore, to load a little bit of machine code, a lot of BASIC is needed, so the program has to be loaded in three parts. Here they are

The third and easiest way is to get a copy of the tape from us. We can make copies for anyone who wants to avoid the boring and accurate typing necessary for this routine to be a success. By the time this article appears, we will probably also have a version of the program for those of you with expanded VICs as well. Because of the vast number of responses to previous offers of help, we had to start charging £10 to cover the cassette, postage and copying time.

You can contact us at

2 East View
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DURHAM

Using the Program

Once the program is fully loaded, then enter 'SYS7353' and press return. You will find that the new words in this article will work for you. Remember that the program was written to make the VIC more user-friendly and more pleasant to use. We hope that you enjoy using our routines and that they make your programming more effective, more rewarding and more FUN!

Writing the Program

We had a lot of fun writing this program for MicroComputer Printout, *and a lot of help as well.*

Because we are more familiar with the PET, our routines were largely developed on those machines, with EXTRAMON and some other gadgets which we find helpful. In order to move routines from the PET to the VIC, we used the Monolith expander board, lent to us by Stack. This has 16K of memory, which can be switched to various locations in the VIC. 4K of this memory can physically be unplugged from the expander board and fitted into an empty socket in the PET. It holds its program even when unplugged, as it has a small battery incorporated into it for backup. In the PET it was filled with a routine and moved across to the VIC for testing. It turned out to be an invaluable tool.

At other times we had PETs and VICs wired together, and were sending programs backwards and forwards under software control. Extra VICs were lent to us by Brian Smith and Margaret McCabe, from the Durham User's Group. To their great credit, and our relief, they seemed singularly unmoved by the sight of all the trailing wires which sprouted from their machines at various times. Their restraint was colossal!

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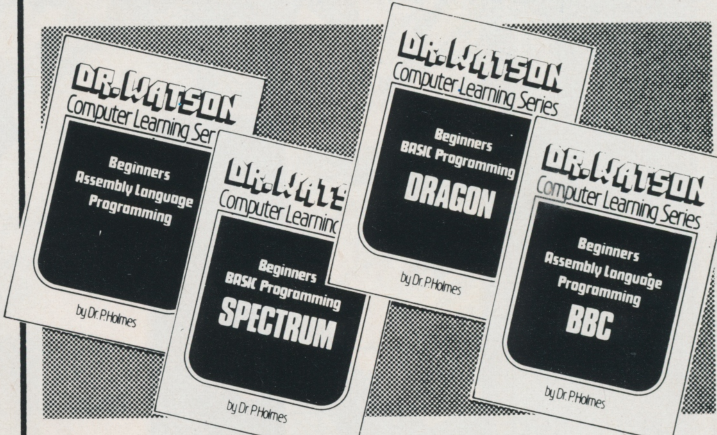

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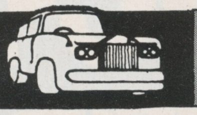
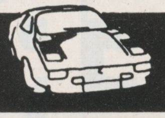
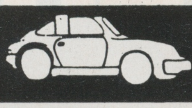
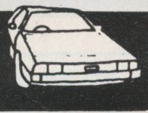
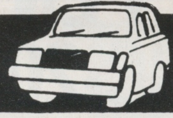
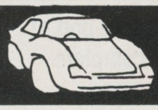
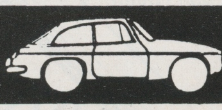
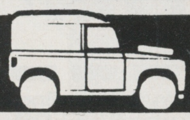
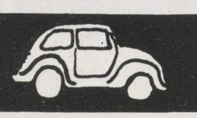
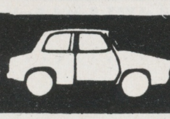
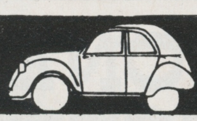
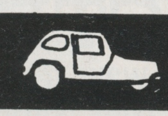
ROLLS ROYCE 	IBM P.C.	If you need to ask, you can't afford it.
FERRARI 	LISA	£7,500 approx + VAT
PORSCHE 	SIRIUS 1	£2,400 + VAT
DE LOREAN 	OLIVETTI M20	£2395 + VAT
VOLVO 	BBC B	£399
STINGRAY 	ATARI 400	£200
MGB 	TANDY 3	£499
METRO	CBM 700	£1,295 + VAT
FORD EDSEL ?	BINATONE	£50
LAND ROVER 	OSBORNE 1	£1,375 + VAT
VW BEETLE 	APPLE IIE	£845 + VAT
SKODA 	SINCLAIR ZX81	£50
2CV 	JUPITER ACE	£90
ROBIN 	NEWBRAIN	£233

Additional blame for this piece goes to Richard Pawson. With apologies to all concerned and special acknowledgements to** The Michelin Red Guide **and** The London Rubber Company **without whose products this guide would have been completed on time.

TONGUE-IN-CHEEK DEPT

Confused by the multiplicity of microcomputer models? There is no need to be if you use our *MOTORIST'S GUIDE TO MICROS*. Wherein JULIAN ALLASON puts his foot hard down to explore the similarities between personal computers and their four-wheeled equivalents.

BASIC EQUIPMENT	TEST REPORT
8088, 64K RAM, 160K single diskette	At 4MHz the only thing you will hear is the clock
68000, 1MB RAM, 1.7MB floppies, 5MB hard disk	Seductive styling; reliability unproven
8088, 128K RAM, 1.2MB floppies	High performance talent puller
Z8000 160K RAM, 460K floppies	Stainless steel gull winged media special; cosa nostra connection denied
6502A, 32K RAM	Safe middle class motoring for all the family
6502, 16K RAM	Distinctly phallic Kandy Koloured Tangerine Flake Streamlined Baby
Z80, 4K RAM	Vintage engineering for enthusiasts
6509,128K RAM, single 720K floppy	Delivery problems and a confusion of models. Good value if you can get one
cardboard	Much ado about nothing
Z80A, 64K RAM	Heavy, ugly, practical, strong – like Mother
6502, 64K RAM	Obsolete but immortal
Z80, 1K RAM	For those who can't afford a real one
Z80A, 3K RAM	Looks and rattles like a dustbin
6502, 32K RAM	One wheel less than you expect

Notes: Models referred to under Basic Equipment and Price are the cheapest configuration available. Disk drives not included unless it says so, chums, although they are probably available as optional extras. Ditto printers and Go-Faster stripes.
Home computer prices include VAT. Business computers exclude it.

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VISICALC	32K/96K RRP £200.00, our price	£160.00

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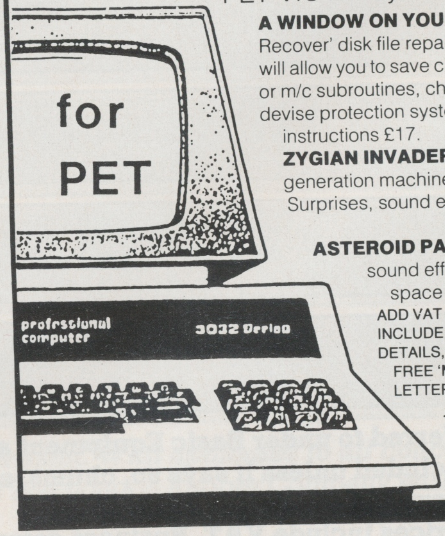

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MARTIN HAYMAN'S

“PROFILE” ON

History, it is said, repeats itself. Subscribers to the teleological view could do worse than search the annals of the computer business if they seek evidence of this theory. The backwards and forwards surge of capital is perhaps an unlikely place to look for patterns, but really the movement is ever onwards: the next wave is always the biggest. Right now Apple is the next wave.

Apple has just had its most successful year ever, with sales of $580m. Its sales topped $200m for the last quarter of last year alone. It no longer talks about ‘if’, but ‘when’ it will reach the Fortune 500 – the index of the biggest-grossing companies in the US. If it does, it will be the youngest company ever to do so. It talks of spending $50m every year on research and development. This is a staggering achievement for a company which, as just about everyone must have heard by now, was started in 1976 by two young men, Steve Jobs and Steve Wozniak, working out of a garage, who raised the launch capital to build an order of 50 from the sale of a pre-owned Volkswagen van and a programmable calculator. The computer prototype took six months to design and a mere 40 hours to build.

The company's success is the more surprising because it relies largely on that one ageing machine, the Apple II, in an industry where technical novelty appears to be paramount. Though according to Adam Osborne it isn't. He ascribes Apple's success not to the ingenuity of the product or indeed the dynamism of its youthful progenitors, but to the solid understanding of Apple's backer, marketing chief and eminence grise, Mike Markkula, of the simple market expedients of outlets (lots, and ▷

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one in your neighbourhood); service; and support.

"Markkula was the only one in the business in 1976/7 who understood that simple list," reckons the Big O. Heard it before? Right: Osborne describing his own operation. But before that was another wave...

Fortune 500

Long before there were micros, there were minis. And there was a firm known as Data General, who set the cat among the pigeons by playing rough and tough. They started in 1968, and it took them a decade to get into the Fortune 500. DG put Digital Electric Corp's nose out of joint something rotten, but then, in their turn, doubtless DEC – world's No.2 in computers – cost IBM more than a fleabite, even when mainframes ruled the roost and a minicomputer was something you put in a small room rather than a big one. And as for IBM, long before transistors and the like, when the acme of business software was the stack of Hollerith punched cards, and salesmen travelled on trains, you may be damn sure that John L. Watson and his team put somebody else's nose out of joint. Then, *they* were the next wave; now they're in the Fortune 500, and pretty near the top of it too.

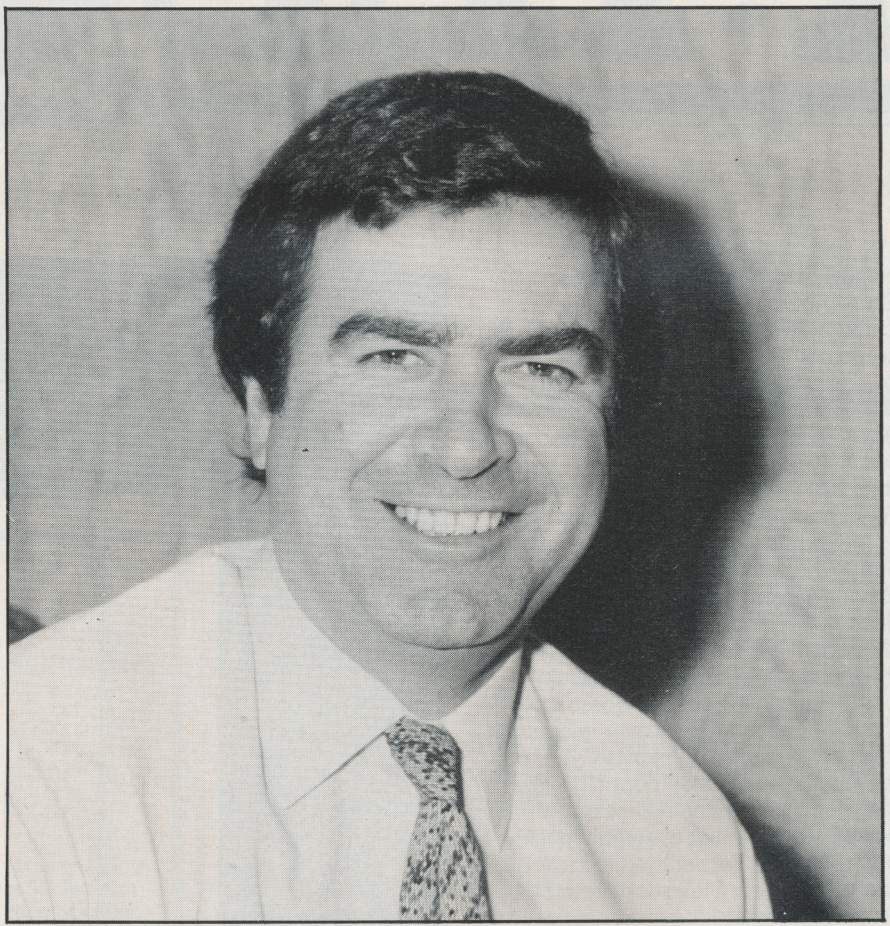
Undoubtedly Mike Markkula is one of Apple's biggest assets. It's debatable whether the two Steves would have got far with their garage computer without enlisting his experience on their side. As a former marketing chief in two not exactly unknown semicomductor firms, Intel Corporation and Fairchild Semiconductor, he had already made a pile and was reputedly a dollar millionaire. He was able to introduce the Apple boys to sources of venture capital without which Apple would merely have shrivelled: firms with resonant names like Venrock Associates, Arthur Rock & Associates and Capital Management Corporation; plus, for good measure, he put in some of his own.

Markkula certainly must have understood the nature of the marketplace, volatile as it is; there is a consciousness among Apple people of their customers 'out there' (a favourite phrase) and the sheer availability of the kit must, in the early days before the turn of the decade, have been a strong enough argument. Because of its simple, modular construction, just about anyone could configure the system with their own boards, and soon a whole sub-industry of add-ons was going for the ambitious punter's cash: plotters, graphics tablets, communications interfaces (one polytechnic hobbyist relates using a high-speed communications card to interface his Apple with a Prime 550 and he was by no means alone), digital music synthesisers, Z-80 softcards if you insist on CP/M, the usual add-on memory boards and A-D converters for instrument control; the Apple was even the first microcomputer to be approved for connection to British Telecom's network, and you may imagine how arduous it was to make that stick.

Serious tool

And not only kit: Apple seemed to get the best software releases soonest, with the undoubted clincher being Personal Software's VisiCalc, which arrived in this country in early 1980. This renowned piece of software had been adapted from mainframe use by Dan Bricklin and Bob Frankston, curiously working out of Massachusetts rather than California, and soon to become the world's hottest-selling piece of software.

Peter Cobb – Apple UK General Manager – "Ultimately my job is to earn dollars for the US shareholders. There are all sorts of wrinkles to this thing: where are these things bought, how long forward, managing exchange exposures, there's a whole sophisticated exercise going on designed to avoid the consumer having to cough up simply because the exchange stays low. That's not good business practice in my view."



One reviewer of the time wrote, "We were unable to find any bugs in the program or to crash the system". Given that it would run in a mere 32K and a couple of disks, and cost a mere £95, it made the Apple look like a potentially serious business tool rather than an obscure hobbyist's plaything.

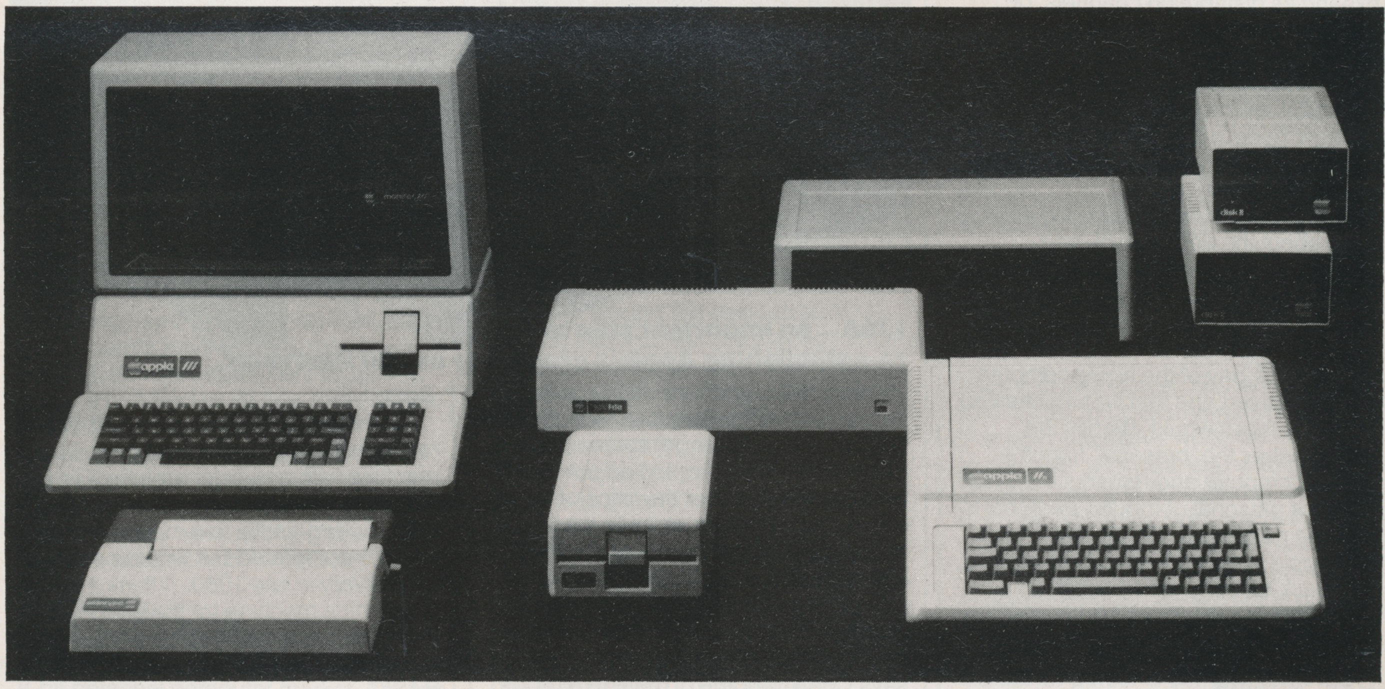
For the fact is that in the US the Apple was seen principally as a 'home' computer. Called on to describe the difference between a hobbyist and a home user, Apple UK General Manager, Peter Cobb, responds drily, "about a year". VisiCalc further elided the distinction between the home user and the business-person and, at least in the UK, Apple rapidly became the first cheap business microcomputer: it could be used for 'serious' office-type work without the user really needing to bend his brain with concepts of computing for which he had no time and which certainly held no charms for him.

Cobb, looking very like Denis Healey, says bluntly: "The great Mr. Prospect now is a perfectly straight-forward businessman like me who doesn't want to play technical games with the machines, doesn't particularly want to know how it works, but just wants it to do a job". In this respect he makes a distinction between the user, typically one such as himself, and the ingenious insiders who saw the retail potential of micros – people like the Brewer Brothers.

Crock of Gold

The Brewer Brothers' story has a 'room at the top' feel. As the first distributors of Apple products they were living proof that there was a crock of gold to be made in micros. Theirs is not a rags to riches story, but there is something of the fairy tale about the way they took the business by the scruff of the neck. Their sell-out price to Apple, when the US company decided it needed to control the burgeoning UK market, has never been disclosed but it was undoubtedly worth several million – far more than any comparable business might have been expected to produce in such a short time.

Their business was already well-established when the word went out that a new firm in California had a product intended as a low-cost hobbyist's computer, but which might have some use in business. In fact the Brothers Brewer had been supplying items to the computer trade since 1964 – mostly furniture and supplies, by mail order.



The Apple III and newly-announced IIe are supported by a new range of both floppy and hard disk systems.

Curiously, though, the first computers which they started to import from across the water were Commodore PETs which, Stephen Brewer says, they bought for around £500 and resold at around £750, yielding a margin of 'around 30% off retail' (sic).

Data Efficiency, as the Hemel Hempstead-based firm was called, was not the only dealer to want in on micros. It was in competition with Keen and Personal Computers to pick the winner. DE ordered 60 ITT 2020s, which were made to Apple's design under licence by ITT Consumer Products, who had approached Apple as early as mid-1977 and been granted a Europe-only agreement. Some arrived; some worked.

"It was not a particularly auspicious start," says Brewer, who was looking to feed a newly set-up chain of 10 dealers in north-west London and the West Country. ITT's partnership with Apple ended after a copyright lawsuit about the design of disk operating system was settled out of court.

A trip to NCC in 1977 has yielded some contracts for distributorships of printers, monitors and boards, but it was not until two years later, also at NCC, that the Brewer Brothers made their big connection: Andre Souson of Eurapple, then the sole European control centre for Apple, appointed Microsense as the UK distributor for Apple. It was a coup which failed to please Data Efficiency's rivals: "Personal and Keen went up the wall," recalls Brewer. From then on Microsense, which had been formed as a splinter company from DE to market Apples, went from strength to strength.

Apple has just had its most successful year ever, with sales of $580m

Freddie Laker

Stephen Brewer was Marketing Director, while his elder brother, Mike was Managing Director. To Stephen fell the lot of organising the dealers, and marketing and advertising the product. One of his wheezes was to hook Freddie Laker in to promote the computer (Sir Freddie was then flying high as a sort of popular hero), though there is some doubt as to whether he ever actually used the Apple installed behind his desk.

Brewer is aware that Microsense was perhaps not too, uh, popular among some of the people who were buying from him but contends that it was necessary to be tough. As Peter Cobb remarks, many of the people who took on micro dealerships in those early days quickly found that it was not, perhaps, the right business for them.

Some were just enthusiasts operating out of their front rooms, and had very little idea of business practice. Brewer decided to use the contentious technique of credit factoring – that is to say, he sold his debts to a collection agency who would invoice the dealers and deal with other routine debt-collection. But the beauty of credit factoring, from Microsense's point of view, was that the collection agency would investigate the credit-worthiness of would-be dealers and assign each one a credit ceiling. This avoided Microsense the headache of attempting to assess the story of anyone who came banging at their door asking for stock on credit.

Microsense itself was among the entrepreneurial merchandisers who made good. In turn the Brewer Brothers reported to Eurapple, an independent organisation which was bought out and run by Apple's own-employee 'commando' of which Peter Cobb was one of the first members. As former financial controller or, as he cheerfully puts it, 'chief bean-counter' for Intel in Brussels, Cobb followed a little later by Keith Hall, recruited from Commodore to take charge of sales, marked Apple's tightening grip on world 'local' markets.

World-wide Marketing

Eurapple handled the marketing and re-engineering, if needed, of all Apple computers sold outside the US with the exception of Japan. In late 1979, in an interview with Yorkshire Apple dealer, David Hebditch of Microtrend, Eurapple chief Andre Souson claimed that he was about to start up in Japan, showing ▷

Apple's determination from comparatively early – Eurapple was set up as a world-wide marketing operation in June 1977 – to expand and compete with Commodore, who had excellent worldwide distribution for its PET, sold alongside its range of successful calculators, and Radio Shack, whose TRS-80 sold through that company's coast-to-coast chain of electrical hardware retailers.

In fact Apple even alluded to its competitors Commodore and Radio Shack in its prospectus for the first public sale of shares in 1980, in which it admitted that 'the company might be at a competitive disadvantage because it purchases integrated circuits and other components from outside vendors, while certain of its competitors manufacture such parts'.

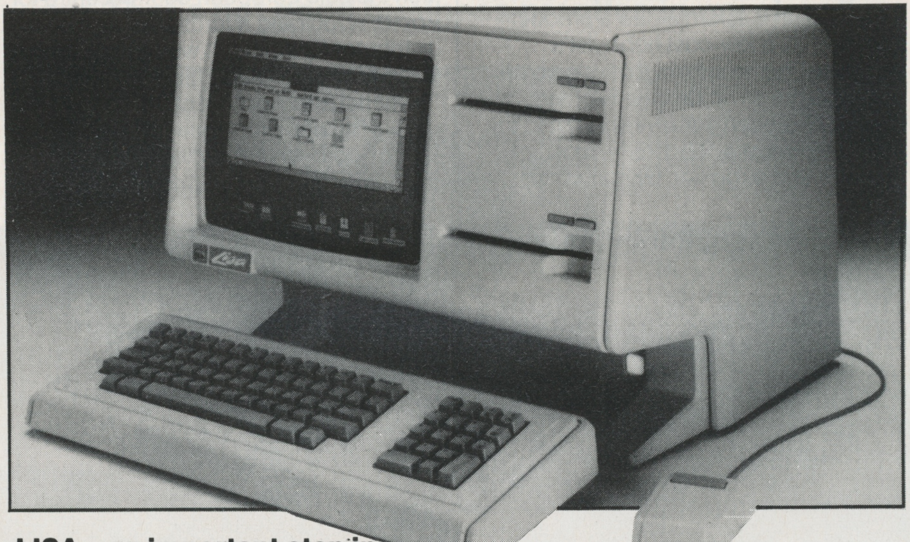
There is a consciousness among Apple people of their customers 'out there'

It owned modestly that it might have to expand its distribution channels, or establish additional marketing arrangements such as a direct sales force. Well, Apple shifted the 4.5 million of its 52.4 million outstanding shares for the right price in December 1980 and a further 2.3 million in May 1981 and they were in business.

Andre Souson, when asked in autumn 1979 about the definition of, and prospects for a home computer, replying on behalf of the company (for whom he was at the time entitled to speak, since he did work closely with Apple Corp) said that the day of the home computer had not arrived and that he had seen no evidence that it would. Rightly, he distinguishes the 'personal' from the 'home' computer and remarks that what makes a personal computer *personal* is that one person uses it. He also shows that Apple grasped the nettle of service and back-up early, and sought to implement a policy of 24-hour turnaround to the end user anywhere in the world.

Over-pricing

It is intriguing to study the prices of mid-1979. Then, the price to the UK customer of a 16K Apple II was £750 (current price of the 48K Apple II Plus, £675), that is, around $1600 at the prevailing exchange rate, compared with a US price of $1200. Import duties for manufactured computers, then as now, stood at 16% (working from end-user price in the UK, nearly $300) and the PAL or SECAM conversion cost was around $80. Then, as now, Apple had to defend its products against accusations of over-pricing on export markets, but it is a fair indication of how well Apple has contained its costs that the stated price to the UK customer is little different now. But then neither, I daresay, is that of the Commodore PET, which Souson identified as the principal competitor to Apple, and for whom he had previously worked as chief calculator design engineer.



LISA – an important step in re-establishing Apple's credibility as an innovator.

Apple still has to defend the price of its product: at the Barbican launch of the 1983 model year range, some were disappointed that Apple had not taken the opportunity to cut the price of its easy-build Apple IIe, despite the fall of the pound against the dollar. This is tricky, because Apple UK buys its computers in dollar prices from the Cork factory in Eire. "Ultimately my job is to earn dollars for the US shareholders," says Cobb candidly. "There're all sorts of wrinkles to this thing: where are the things bought, how long forward, managing exchange exposures, there's a whole sophisticated exercise going on designed to avoid the consumer having to cough up simply because the exchange rate is low. That's not good business practice in my view."

Looking at Apple's technical strategy, Souson let slip some intriguing speculations in 1979, among them the assertion that "Pascal is the language that all our future machines are going to support primarily... It is the sort of language that a lot of people believe is going to be the basis of all the languages of the future". Whether or not this is a Good Thing, if indeed it was an *a priori* decision in 1979, is debatable. Vile rumour has it that the Microsoft BASIC in Lisa actually runs slower than that in the VIC-20, because it has to be interpreted into p-code and thence into its native code.

Furthermore, Souson asserted, "The real question is, do we want to build a machine with a register architecture or not? And I think the answer is no." He then alluded darkly to a machine that was 5% completed but would be ready for delivery in late 1980. "I think it will be a very nice machine for the user." And that's the point: most of the people who use Lisa will not be interested in running BASIC.

if they had been pinning hopes on the Apple III to take them into the 1980s, where the customer is going to want a

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Smalltalk

As it turned out, this revolutionary product appears to have been Lisa. Now we know how it came to take two person-centuries of research and development to get it out on the market. It seems surprising that the ground-work for the astonishing Lisa was then already in progress; that Steven Jobs and software engineer, John Crouch, had already toured Xerox in Palo Alto to look at Smalltalk and were ready to recruit their tour guide (followed later by another 15). Was the design for Lisa laid down that long ago? Souson says the architecture for a 'totally innovative' machine was ready in autumn 1979. Maybe he'd already seen it at work in Palo Alto.

This long gestation for the new model is reassuring. If a great many people have hammered away at it for a couple of years before the customer gets his hands on the product, it is likely to have shaped up. This point is still being made about Apple's bread and butter computer, the Apple II which is sometimes referred to as outmoded. So, too, was the Volkswagen Beetle. And the Apple II, like the Volkswagen, is subject to continual improvement to its subcutaneous performance: the new IIe is the thirteenth revision to the garage computer, and now it is a different and more powerful machine, which nevertheless remains capable of running programs developed ages ago.

People do not like to junk major time investment in intellectual tools, and Apple still understands well that the individual favours continuity. It is becoming more generally recognized in the corporate environment, too: when the US Defense Department proposed to buy a hundred or so new mainframes, it required the contestants, Sperry-Univac and Burroughs, to enter into the lists in a computing tournament to adapt the Department's software to run on the machines they were pitching to sell. But that's an altogether different story...

Ill Feeling

For all that the Apple II has scarcely shown any signs of flagging in the cheap 8-bit personal computer market, it is just as well that Apple has the Revolution slogan (for Lisa) to add to Evolution, for much more flattering interface with his computer, they would have been out of luck. The Apple III has been troublesome for the company and in the UK at least led to ill-feeling among dealers who thought that a two-tier operation was coming into force, with only some of the existing Apple II stockists being permitted to handle the III. In the event they might have been relieved – because on its launch two years ago Apple III was something of a turkey, and 14,000 were recalled, for what Newsweek delicately describes as 'retooling'.

How revolutionary is Apple's strategy? Will Lisa be so easy to learn and use that everyone who deserves one will have a clear desk-top? As an onlooker one can only applaud Apple's determination to improve the computer's model of the human brain engaged in so-called 'mind-work'. The intellectual tools used by the human brain for this sort of work are sophisticated, so any computer which comes nearer to an extension of the human brain, in the same way as a hammer and chisel, a quill – or even, dare I say, a typewriter – is good news. Especially when it costs as little as $12,000 – or is it $9,995 (the latter figure is Newsweek's).

Souson says the architecture for a 'totally innovative' machine was ready in autumn 1979

Truth to tell, an office worker might feel a bit of a Charlie pushing a streamlined dinky toy around the desktop and peering into a screen displaying 'icons' of the familiar equipment now banished from the office – the filing cabinets and folders, the wastepaper bin and calculator, and the ready-reckoner. Secretly he might prefer to invite one of the girls to go and retrieve such-and-such a file, but hell, that's progress.

Clerks of a century ago, used to pens and ledgers, undoubtedly thought the office typewriter a bizarre mode to employ, so who's to deny the mouse? It sounds better than sitting at your office computer talking to it in precisely modulated tones, as Texas Instruments seems to be inviting us to do with its new voice input Professional Computer. That invokes an altogether different muse, a new Thespian slant to computer salesmanship.

Volkswagen

Lisa had better work. Volkswagen came back from the dead when the Beetle finally waned and was banished to local assembly sites, and it took them time to find the right follow-up, but they did. Although Apple Corp's performance is impressive, it has to make sure that Lisa sells well to recoup costs. Its market share in the US has declined from 29% to 24% since the introduction of the IBM PC in August 1981, and the PC will be able to run VisiOn rather more cheaply than the Lisa package. Certainly IBM are gunning for Apple, who must be kicking themselves for not using Personal Computer; after all, say Apple, "We invented the Personal Computer" – one of the big sales slogans in dealer motivation pep-talks. Stewart Lakey of Personal Computers, London, reckons that even if he had a hundred Lisas in stock right now, it would take him more than a year to sell them: as well as being an Apple dealer, Personal handle both DEC and IBM.

Definitely on the stocks for the future, and enjoying the whole-hearted attentions of Steve Jobs as project leader, is the economy Lisa, which may well also be based on the Motorola 68000 and is aimed to sell at around $2,000. Why MacKintosh? I hope it's not an acrostic, but is it anything to do with outgoing Apple President Michael Scott who, it is reported, refused to let young Jobs run the Lisa team because he was too inexperienced? Come what may, Jobs will have to keep his nerve, because IBM is said to be ready, with its own 'Popcorn' executive workstation aimed to compete with Lisa, and a 16-bit 'Peanut' machine designed to undersell even the Apple IIe. But none of this blue sky has been seen yet. It will be interesting to see whether, as some people predicted, the era of the garage microcomputer is over, now that the punks have shown the big boys how the market for personal computers works. Apple should be in the Fortune 500 this year, and that's good going in six years. ○

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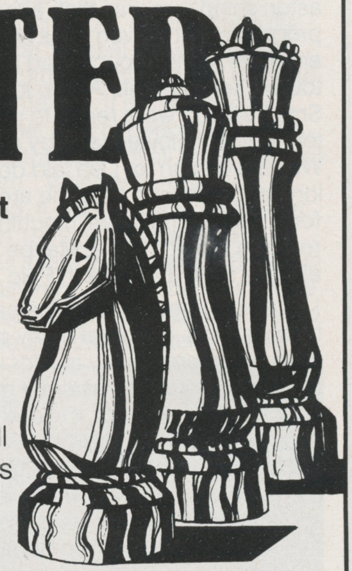

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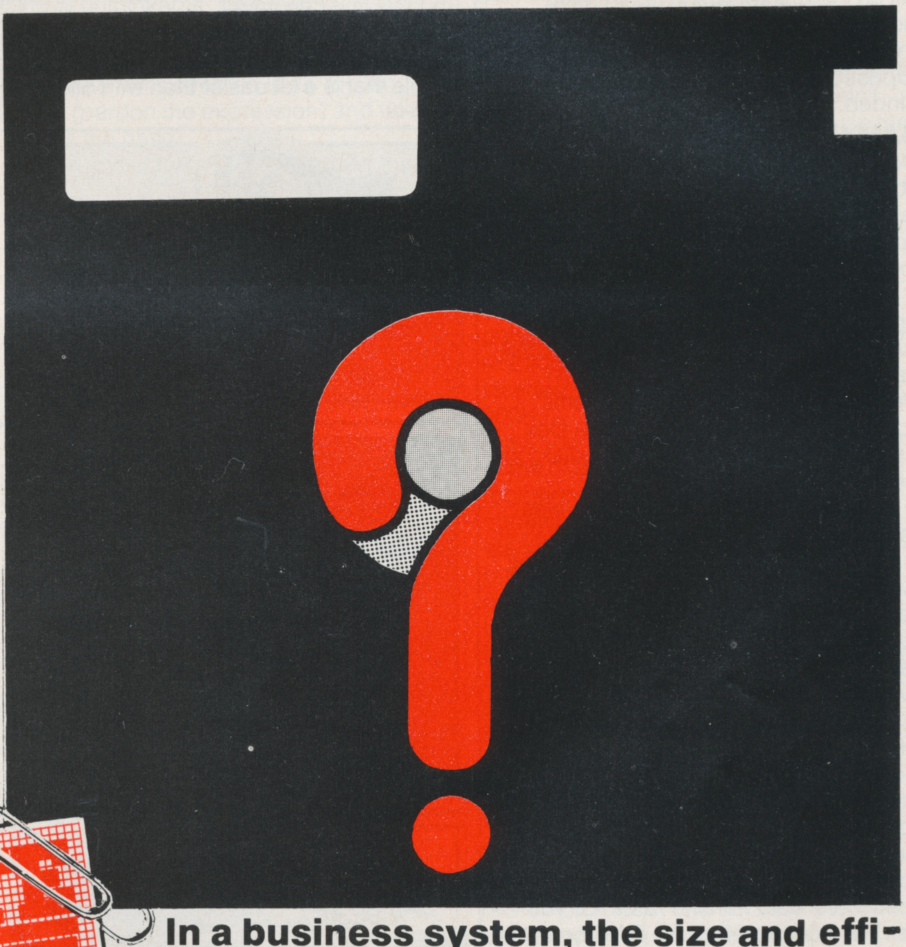


STATE OF THE ART REPORT

In a business system, the size and efficiency of your storage is critical. Having ruled the roost for five years the floppy disk is now showing its age. RAM disk and microfloppies now represent the State-of-the-Art as reported by *John Gowans*.

"The time has come," the Pawson said,
"To talk of microdrives:
Of disks – big RAMs –
and Winchesters –
of bubbles – and Sir Clives –
And whether all this storage stuff
Will alter readers' lives!"
"But wait a bit," the readers cried,
"This must be a joke;
For most of us just use cassettes,
And all of us are broke."
"Don't worry," quoth the editor.
"Would I mislead you folk?"

– from "The Editor and the Readership," an article commission in several spasms.

With a subject like that, how could I refuse? When it comes to computer storage we technology junkies start to salivate, and imaginations are unbound. All the fuss about this microprocessor thingy does not fool us – without memory the most wonderful CPU in the world might as well be used to prop up a table leg.

And if the readers cry again that memory is old hat, prepare – as the Editor would say – to hold onto it. For storage is yet another of this year's big things, and the activity in the business makes a termite colony look like the reading room at the British museum.

Not just in one area either. The bandwagon here has space enough for effort in all areas, but the trends are in one direction; towards denser – smaller – faster – cheaper means of sticking programs and data away for a rainy day. This, of course, is the direction that the chip business has been following for a decade or so, so the memory chip seems a good place to start. (And here is a policy statement: none of the 'memories are made of this' stuff. Frivolousness will not be permitted except to excess.)

Memory chips are easy to spot once you have the computer's lid off, since they are the only ones laid out in neat rows. And compared with the computers of even a few years back, there now tend to be rather more of them.

Cheaper RAM

There is a simple reason for this; the users are demanding more memory these days. Larger games and applications, the desire for fewer time-consuming accesses to disk while running, and the flashy colour graphics that are now becoming standard all take up large slabs of the stuff. Fortunately, the latest 8-bit and 16-bit processors make it technically possible to build in large RAM capacities – and even more fortunately, the RAM chips themselves are getting cheaper. The 16K RAMs, (each chip holding 2K bytes of 8-bits each), are being given away in cornflake packets while the 64K chips are now coming out in the kind of volume that sends prices through the floor. NEC and Fujitsu in Japan are openly (as openly as the Japanese ever do, that is) saying that each of them will be making around five million 64Ks *per month* in 1983. For manufacturers outside Japan the price is still running at around £2.80 per chip, but that will come down as the Japanese firms find that their warehouse walls are bulging with the things.

Inside Japan, without the slightest scintilla or shadow of doubt about protectionism, the price is much less than it is outside, and the Japanese machines now filtering over here at inflated prices all have staggering RAM capacities. For instance, the Hitachi 16000 has 192K of RAM just for the screen, with 256K for the real computing. ▷

This pinpoints one of the uses of big RAM space – graphics. BBC owners particularly well know that the use of neat graphics eats up RAM like those termites we mentioned earlier.

But the cheapness of RAM now means that there is a brand-new use for it – treat it as a disk.

What a concept, eh? For generations – well, since the micro started seven or eight years ago – microcomputer owners have got used to floppy disks as that great storage medium in the sky, certainly outstoring whatever pathetic amount of RAM the machine has inside. But the Apple III, that well-known gonzo among machines, broke the mould.

For the first time, a machine had been put on the market which could have more RAM space than could be stored on its single disk. (That's 256K as opposed to 143K, for the numerically minded.)

RAMdisk

Once this precedent has been set, just about the only thing that can be said in favour of the Apple III, things progressed apace. The keyword 'RAMdisk' started to be heard.

The idea is really simple. Stick a big lump of RAM into a system and use it like a disk. Cut down all that disk access waiting time, the thing that makes WordStar and the Atari disk systems both such pains. Get at your data files instantly. Search database data disks in milliseconds. And so on.

And for once, the practical side was as easy to do as the theory.

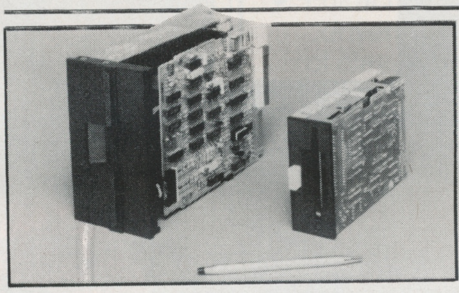
Microcomputers deal with disk drives over parallel (or in some cases serial; damn you, Atari!) interfaces. Sitting between the computer and the drive handling the interface, is a board, or even a chip, called a disk controller. So, to implement a RAMdisk there are two things you can do.

You can make the RAM board look like a disk drive, and fool the existing controller into thinking that it is a bloody fast disk. Not really too good, since the speed of the RAM is too much for most controllers' data transfer rates. Or you can put a controller on the RAM board to handle the transfers, and fool the computer into thinking that all of a sudden its disk access data is there for use a lot quicker than usual.

There are many examples of RAMdisks around. On that old and gnarled favourite the S100 bus the big name is Compupro, part of Godbout Electronics, which is a thing called the M-Drive. The name is significant; the Godbout/Compupro systems deal with CP/M as their operating system, and as we all know (at least since the *MicroComputer Printout* supplement on CP/M wot I wrote last August) CP/M handles disks by letter.

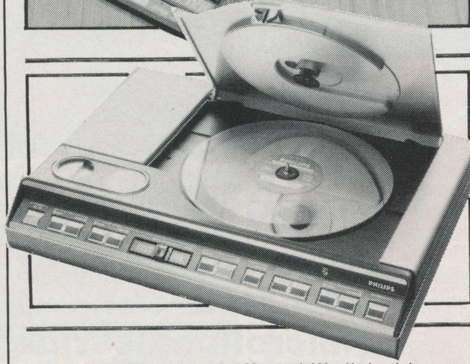
Most CP/Ms can only have A, B, C, and D, but Godbout's version supplied with the M-Drive lets you use the RAMlump as drive M in the system.

With the M-Drive you can treat drive M like any other, transferring files from disks into it, loading files from it, and so on.



The microfloppy represents a significant reduction in size yet increase in storage capacity – ideal for portable machines. Currently there are several 'standards' but the 3.5 inch diameter developed by Sony and adopted by Shugart is emerging as the winner.

The Scorpio 8 from HAL computers is a novel solution for those who need large storage capacities. Offering 6.2 Megabyes for £750, the Scorpio works like a floppy disk juke-box – selecting any one of five floppies from a removable cartridge. To the computer, the Scorpio appears as one large 8" floppy, so existing software needs no alterations.



Videodisk offers mindblowing storage potential, though getting your permanent records recorded could cost you £2500. Recent developments, however, suggest that the Read *and* Write video disk could by just around the corner.

Apple Cards

In other systems the same techniques are used. The Apple's expansion slots have a wide choice of boards that plug into them, and sure enough there are RAMdisks to go along with the 80-column cards and IBM 370 processor boards or whatever. *Vergecourt* in Essex does one of them, although the RAMdisk angle is not the one that is pushed; and so does *U-Microcomputers* in Warrington, where Dr. Bill Unsworth has a very similar product.

Both companies stress the extra RAM first, with the marketing based around VisiCalc (which God preserve) of Boston. With the 128K RAM board added, the adverts go, just think of the VisiCalc models you can have!

However, the RAMdisk option is there with a bit of extra software, and with the Apple that is a lot easier than with other systems. The Apple II and III disk drives only hold 143K, remember, so 128K of RAM is near as dammit the same. And the RAM costs around £275, compared with over £300 for a disk drive, plus controller.

Some new machines even have the RAMdisk concept built in. The Sage II, from Rod Coleman's *Sage Computer Technology,* is one of the super-flash 68000-based 16-bit machines – going four times faster than the *IBM PC* to name but one. This system comes with 128K RAM standard. But it can take 384K of extra RAM (giving a half-megabyte total – the numerate among you are getting a field day here) and this is *intended* to be used as a RAMdisk. All the necessary facilities are provided in the unit's UCSD p-system operating system.

Now this is wonderful, and as RAM gets cheaper the cost differential between RAMdisks and disk drives will increase. Great news. But – RAM still might as well not be there when you turn the power off, and a RAMdisk board or module is just the same.

To put it bluntly, the RAMdisk is pretty much useless unless you have a disk drive already. The program or data needs to be loaded from disk into the RAMdisk before you can use it, and after you have finished you have to dump the RAMdisk back onto a real disk to save it for posterity. Unless you are insured against power failures and kicking the plug out of the wall, RAMdisks are dangerous; and of course, with reasonably-sized RAMdisks the extra RAM can only hold one disk's worth.

For archival use, the floppy – fragile though it is – is a damn sight better.

Stringy Floppy

The progression of most micro users, apart from those with private incomes, legacies, or a company buying budget, is from the machine with its RAM through cassettes to disk. But the jump from cassette to disk is still enormously expensive, and even the smallest floppy drive is well beyond most home budgets. The manufacturers are working on this one too.

The need is for some kind of middle ground between the cassette and the disk, and the first attempt was the stringy floppy – an absolutely horrible name, adopted by one of the first exponents, *Exatron*. These use small, fast cassettes called wafers, with extra software to make the computer treat them like disks.

Although the price was typically less than half that of a floppy drive, the stringy floppy never really got anywhere, although for a while it was in vogue for *Tandy TRS-80* systems and (surprise, surprise) the slavish *Video Genie* look-alikes.

However, the stringy floppy brings us to one of the great unsolved questions of the age. What is 'Sir' Clive Sinclair up to with his Microdrive? The evidence so far is that the esteemed gent is having trouble getting the product out at the promised price, if at all. The latest information concerns 'Lord' Clive's advertising, although we do not normally concern ourselves with the disciples of Mammon.

It seems that Sinclair booked eight consecutive pages in the major micro magazines to show off something or other, and cancelled it close enough to the last minute to give production controllers palpitations. In the event, all we got in the ads was the usual, but it seems likely that the banned pages will finally push the Microdrive.

Microdrive

What exactly the Microdrive is has not yet been revealed. At the Spectrum launch the impression was that the £50 Microdrive actually had a floppy inside. Later, bets were hedged and the stringy floppy option gained credence. One thing that is sure is that the August launch date has been missed (did you notice?) and that no new date has been given.

'Dame' Clive, the great Cambridge stone face, is not saying what is going on. But rumours fly; including one scurrilous suggestion that the launch has been delayed because the loading of a program from a Microdrive took longer than it did from cassette.

Hold your breath if you like, but don't expect 'Cardinal' Clive to pat your back when you start to turn blue.

But even as the stringy floppy (ugh!) started to die the death of a thousand apathies, another possible mid-range solution rose over the horizon like a rising sun. Geddit?

Yes, it was from Japan that the next move came. *Sony*, the home of autocratic management and Genghis Khan quality control, announced its new floppy drive.

This was no high-capacity 5.25in. drive, or even a half-height, third-height, or quarter-height version of the same. What *Sony* came out with was the 3.5in. floppy drive.

The *Sony* unit had its little floppy disks sealed inside hard plastic cartridges that, we are told, fit into a shirt pocket if your shirts have such nerdish features. The initial capacity in one of these little things was 250K, and *Hewlett Packard*, the Rolls Royce of microcomputing in price if nothing else, signed up to build the drives in its systems. The first fruits of that deal are now emerging in the HP120 series.

Transportable

Even more recently, Computer Devices put Sony drives into its Dot machine, an IBM look-alike that does not take up desk-space-alike. In other words, a transportable rather than a portable IBM PC.

But as soon as Sony came out with the drives, there were stirrings inside Japan. Sony has not been popular with the other giants ever since it went its own way on video cassette standards with the *Betamax*, and a Sony standard was almost unthinkable. Before long, *Hitachi/Maxell* had come up with a rival 3in. floppy drive standard, and other Japanese firms seemed likely to string along (pardon the expression) and take that as the base.

A couple of things have stopped that so far. First off, the US disk drive and media firms decided that a united front was the only way to beat off the Japanese, and set up the Microfloppy Standards Committee in May last year.

This committee has representation from 19 US firms, and agreed a sub-5.25in. standard that they would all follow – and that choice was for a 3.5in. drive rather than the Hitachi 3in.

The first fruits of *this* are also emerging now, with 3.5in. drives coming from floppy giants *Shugart* and *Tandon* and matching media from people like *Wabash and Dysan* (which still sounds like a sanitary plumbing firm to me). And, surprise, surprise, it turns out that the US disks are compatible with Sony's media, while the interfaces are the same as the industry standard for the 5.25in. drives.

The general manager of Shugart's microfloppy project, somewhat ironically named Dr. Yoshi Narahara, says that it went for 3.5in. because, "it is large enough to hold 1 Mbyte of capacity without overtaxing existing technologies," and because the data transfer rate can be made the same as that of the larger disks if the drive runs at 300 RPM and 80 tracks are used per surface.

For now, Shugart's SA300 drive holds 500K, but watch this go up.

Meanwhile, back in a workers' paradise, something odd was stirring. With all the grace of the creature from the black lagoon, a Hungarian cassette recorder maker has entered the lists to take on Sony.

Iron Curtain

The Hungarian outfit, catchily called *Budapesti Radiotechnikai Gyar* (15 accents omitted to save printers' heartburn), had been commissioned to do a microfloppy drive for a Scandinavian equivalent of the BBC's Computer Programme – and once this was done the idea of selling them into the UK home computer market struck the Iron Curtain co-op. And the state-owned instrument exporter, *Metrimpex*, started to toy with the plan.

At this point, enter Bill Musker and *BATS-NCI*. Musker and his London-based company has been dealing in Hungary for quite some time, and on a visit there he spotted the microfloppy. Before you could say – well, Budapest Radiotechnikai Gyar – BATS-NCI had tied up the UK distribution rights.

As a result, one stand at last year's PCW Show at the Barbican had a somewhat odd appearance. Posters o Budapest and the workings of the state bus factory adorned the walls, and Slav characters in sharp suits from the Hungarian Embassy formed the honou guard. It was one of these gents who told me that BRG (to cut an outlandish name short) made more cassette recorders – 600,000 a year – than anyo else in Europe. Adding that, 'we didn't see many of them over here because t majority were travelling into a gigantic and pretty much captive market in the opposite direction'.

What the Hungarians and Musker ha then, and still have now come to that, i the MCD-1 3in. floppy drive. Like the others, the disks themselves are in har plastic cases with windows that open f reading and writing when the disks are inserted; and the capacity is around 200K.

As you will see from the size, and fro some of the ways the drive is put together, the BRG drive has more in common with the Hitachi/Maxell versio than the Sony and US-conglomerate ones. And indeed, the man from the Embassy hinted darkly that Hitachi ha nicked some of the design features fro the MCD-1 – an accusation that is deni in no uncertain terms by the Japanese giant. I think Hitachi was cross at the suggestion that the mighty Nippon technology machine could learn from the tractor-factory brigade – but we wi probably never know.

Robust and Cheap

But be that as it may, the MCD-1 has picked up a lot of interest. Grundy has version working on the NewBrain, and Grundy marketing boss, Andy Surtees is keen to go ahead with the product if he can be reassured over supplies of the media and the price the Hungarian single source charges for it.

Premier Publications, which specialises in software and hardware add-ons for the UK101, Superboard, and Tandy/Genie machines, has put together a version for the micros it supports as well. And most (prospectively) lucrative of all, Commodore has been actively looking at the drive as an extra peripheral for t VIC and the 64. No firm news on this front yet.

But what do these microfloppies promise for the readers? Fundamental they promise a smaller, cheaper, and more robust alternative to the 5.25in. size.

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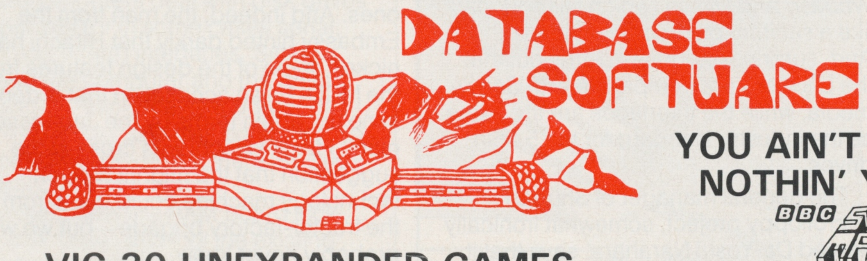

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sound great. Any user of ordinary minifloppies will tell you of the neurotic twitches that develop whenever vital stuff needs to be saved. Will it do it first time? Or has the cat been using the disk box for a scratching post again? The machine this article is being written on – yes, some of us do practice what we preach – has a particularly endearing fault of scrambling the text as you save it, with the unpredictability of a RND(1). Microfloppies will bring more confidence.

And the prices should make them ideal for the home market, even though they are unlikely to come in at 'His Imperial Highness' Clive's fifty quid. The Hungarian MCD-1 costs the end-user around £120 when the controller has been added to the bare drive and a box built by OEMs like Grundy and Premier. The Hitachi model is not yet available here, and although it is on sale from Amdek in the US, that firm is reticent about prices for its twin-disk drive that goes into the IBM PC. But expect a similar rate to the MCD-1 here; maybe a bit more for the extra capacity.

So much for the three-inchers. The bigger size will be more expensive. Both Shugart and Tandon, the two with products launched already, say that drive prices will be 'under $200' for large quantities – and that's just for the bare drive. By 'under $200' they mean the same as Marks and Spencer do by under 200 anything; viz, $199.99.

Whining Tunes

And as for Sony, if you buy from Hewlett Packard you can double that. HP is well-known, if not notorious, for its pricing policy which is idiosyncratic at best and inflated to the point of lunacy at worst. There will be few cheap deals on the Sony drives yet, since more OEM contracts are in the pipeline, but not yet final.

All this surging around in the microfloppy depths is having only a peripheral (sorry) effect so far. The 5.25in. floppy drive still rules, and is still moving higher and higher into the capacity stratosphere. A megabyte or so on a single disk is now reasonably common, using various techniques. The cleverest so far is used on the Sirius, although nobody, except possibly Apple on the Lisa, has done the same. The Sirius drives simply spin faster as the heads move towards the edge of the disk, and slower as they move towards the centre; this explains those nagging whining tunes that the Sirius plays as it works the drives.

Other manufacturers are looking at new disk coatings, new head technologies like thin film, and new mechanical designs.

But the tops for floppy capacity so far must go to Toshiba, which as put – hat-holding time – over 5 megabytes on a disk. This uses an arcane technique called vertical recording, which crudely means that the ferromagnetic domains that from the recording surface are stood on their ends, rather than left on their sides. And since the domains are shaped something like Valium capsules (the closest lookalike to hand) that means that the density is more than doubled.

Vertical recording is also in development for Winchester drives, and then the capacities will really start to get out of hand.

Of course, there are those who would say that Winchester drives are already well out of hand. It is all very well to use techniques like plated media and thin film heads, not to mention the eventual – God help us – vertical recording, and push 5.25in. Winchester capacities up towards 100 megabytes. But what happens if you want to back all that data up and lock it away safely in case of a head crash or lightening strike?

Back-up Problem

It was ludicrous enough of Apple to boast that its ProFile Winchester held the same as 37 Apple floppies, when the only method of backing the drive up was to use those 37 floppies. And the ProFile can only hold 5 megabytes.

The back-up problem is still pretty much intractable. High-capacity floppies help, naturally, but this is still by no means ideal. And the tape solutions are not much better. Data streamers are hellish expensive, and video cassette back-up a la Corvus Mirror and Alpha Micro's system, is cheap but slow.

The mainframe world had the same trouble, and got round it with removable disk packs – those things that look like giant white cake covers. But the main selling points of the Winchester in the micro market are the low head flying heights and the extra reliability made possible by sealing the disks and heads inside a case with carefully scrubbed air. All that disappears if the disks are made removable. Or does it?

These days the answer is 'no'. The Winchester makers are all going for the ideal of the Winchester cartridge that can be treated like a giant tape cassette or an inflated microfloppy disk. The cartridge just holds the disk itself, clamped in place to stop any damage while the cartridge is outside the drive. Pushing the cartridge into the drive slot releases the disk, which is then spun up to speed before the read/write heads slip into the cartridge through automatically-operating doors.

This necessarily means a decrease in reliability, but it is worth it for the convenience of removable media.

But – there is always a but – the precision engineering needed in both drive and cartridge mean that the solution costs enough to make it almost worse than the problem. Which is why IBM, among many others, is keeping a close eye on the work of small start-up firm *SyQuest*.

Winchester Cartridges

What SyQuest has done has come up with yet another disk size, the 3.9in. Winchester. But this is a Winchester cartridge drive holding 4 megabytes.

And most important of all, the going rat for a SyQuest cartridge is around $40. None of the other disk makers, even th giants like Dysan (didn't I see that nam in a caravan cubicle?). The official standard for Winchester cartridges onl covers 8in. units so far, and at present SyQuest is out on its own with a smaller size at a much smaller price. We, too, are following its progress with interest. is already starting to appear in US syste adverts – although we all know that doe not mean it is available and working in the systems shown.

So we can work on the assumption that the Winchester back-up problem will in the end be solved by cheap high capacity cartridges, and that Wincheste capacities will go up and up and up unt they satisfy all but the most voracious data squirrels.

And that is still not the end of the storage story.

In November 1978 – stop me if you've read this from me before – Philips gave me an invite to the Eindhoven bunker fo a demonstation of a new product. And what it turned out to be was the optical data disk, the laser-driven storage system that came out of Philips' videodis research and could store ten-to-the-ten bits – that's around *1,000 megabytes* – on a single 12in. disk.

You may remember this as a sideline to the videodisk feature we ran some time back. The optical data disk is encased in plastic, and scratches or ultraviolence have no effect on it; the drive is a precision engineering job, but basically simple (the prototype in Eindhoven looked like a 1960 Dansette); and the capacities are quite simply staggering. The one big drawback is that once data is written on the disk, burned in with the laser, you can't erase it. At the 1978 do Philips said this didn't matter, since there was so much room you could just write the updated data somewhere else and forget the original. And for archival use, of course, the technique is ideal.

Videodisk

But since then, for the last five years, Philips has kept very quiet about the data videodisk. The consumer TV-storage version has come out to not much of a resounding reception, but the professional is still under wraps.

However – and there is always a 'however' to go with a 'but' – recent developments in Japan hold out hopes of an eraseable laser data disk. In the new technique, the laser does not burn holes, but interacts with a special disk coating in some kind of photomagnetic effect. The prices for such a system would be astronomical today. Tomorrow they will still be stratospheric. The day after we'll all want one.

"Hope it moves a little slower," said the writer to the Ed. "All this storage escalation is just damaging my head."

From 'The Memory Quadrille'. (Exit stage left, pursued by a laser.) ○

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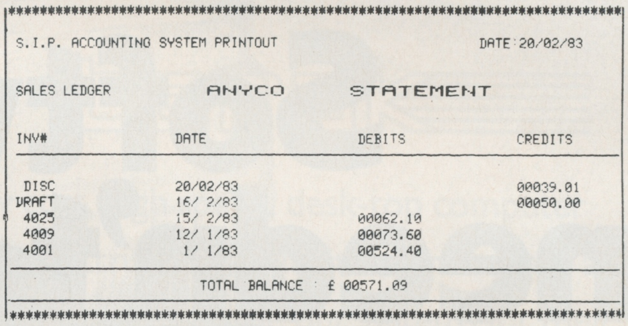

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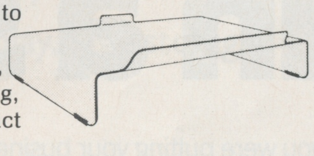

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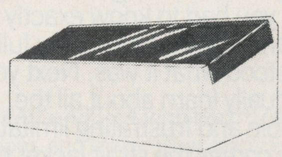

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EXPERT'S CHOICE

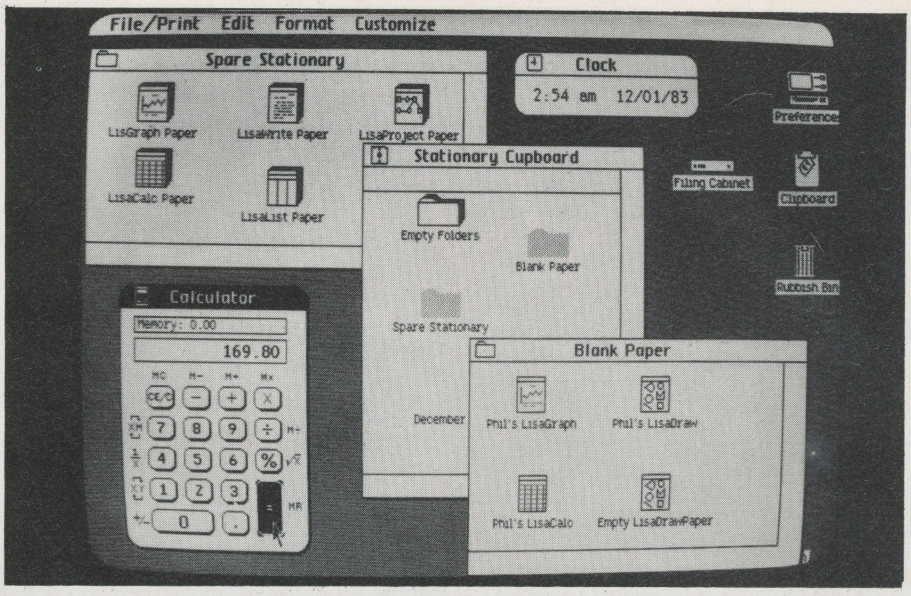
Each month one of *MicroComputer Printout's* team of experts gives a vast amount of free publicity to a product they happen to like. *Julian Allason* opted for Apple's new LISA – because, quite simply, it works the way you do.

APPLE LISA

▷

SOFT SOAP

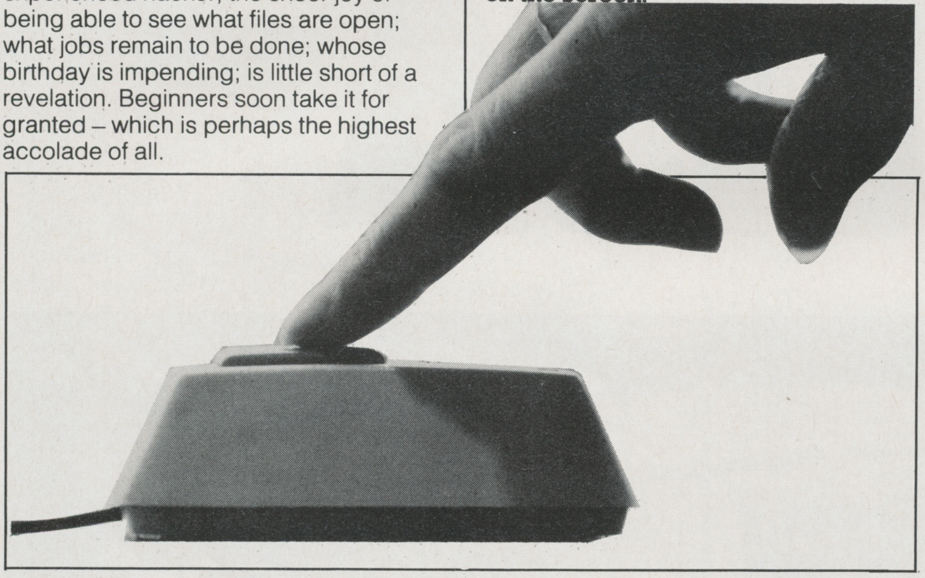
Julian Allason is critical of LISA's Software.



The movable mouse with its single 'select' button is used to point to a function on the screen.

"*A soft answer turneth away wrath*" says the Bible's book of Proverbs. And answers to the microcomputer problem come no softer than *LISA*. Indeed, so friendly is she that the doyen of micro dealers, Mike Sterland, professed himself worried that existing Apple clients might be jealous at the thought of mere newcomers enjoying her sundry charms.

There can be little double that what I suppose we must call the *LISA* operating system – although it is so transparent as to be invisible – is superbly executed. After a few minutes one is merrily scuttling the mouse across the table top; selecting here; opening there; consigning files to the waste basket, and drawing the prettiest of pictures. To the experienced hacker, the sheer joy of being able to see what files are open; what jobs remain to be done; whose birthday is impending; is little short of a revelation. Beginners soon take it for granted – which is perhaps the highest accolade of all.



But is the applications software (although again this is a term Apple wouldn't dream of using) as good? I fear not.

Like the curate's egg, it is good in parts. The authoritative Rosen Electronics Letter, describes them, with the exception of *LISADrawer* and *LISAProject* as 'pedestrian versions of standard functions that have been better done elsewhere'. Quite so. The point, however, is the degree of *integration* between them. Unhappily, even this is not as comprehensive as it might have been, The *LISAWrite* word processor for example does not allow you to insert information from the other applications, except by adding an extra page to the document you are working from.

If you are the sort of writer who needs fancy functions like footnote management and indexing, you would be frankly better off with *Wordstar* (and it is just a matter of time before *that* appears on *LISA*). On the other hand *LISAWrite* gives you lots of type faces and sizes to play with. And you can print them all out exactly as they appear on the screen, using both Apple's new dot matrix printer, and, amazingly, the daisywheel printer. Most of the usual functions for manipulating text are there, and in my humble judgement, the program is more than adequate.

Much the same judgement must apply to *LISACalc*, which would be a fairly run-of-the-mill first generation spreadsheet if it didn't offer variable column widths and one or two other goodies. One criticism levelled at it is the absence of multi-sheet consolidation, a feature which might have been expected to appeal to the corporate users who supposedly consititute *LISA*'s target market.

LISAGraph offers the usual types of business graphs in four different sizes. Thanks to the 720x364 dot resolution of the 12" screen, they look a lot better than on most other micros. Up to seven different sets of data can be held, and converted into graphic form.

This data can either be keyed in directly as a set of values, or moused over from the Calc program. The point that caught the eye of almost all lucky enough to have had a sneak preview of the system, was the way in which the graphs change automatically following any amendment to the data. Clever stuff!

LISA Terminal is optional, and it sounds like, and emulates DEC VT100 and VT52 modem and terminals. IBM 3270 emulation is likely to be included by the time *LISA* goes on sale here sometime this summer (is September still the summer? "It's real hot out here in September," says my chum in Cupertino with a wink).

And now the exciting bits. *LISADraw* is astonishing. If you're drunk it will even straighten out your lines. Combine it with *LISAGraph* or *LISAProject* and the results get to look very professional indeed. The first time I saw *LISA* the demonstrator, Apple's Brian Reynolds, created first one, then a whole series of drawings of *LISA* just by selecting from lines, shapes and shading with the mouse. And, Apple II users please note, text can go anywhere on the screen.

"It was hard to hear the commentary for the sound of eyes popping" – Peter Cobb of Apple UK on the LISA seminar for blue chip customers.

LISAProject is for critical path analysts. I'm no expert on project management, but even I could understand the schedules when they were displayed in graphical form, showing the critical paths amongst tasks, represented by boxes containing the details of the resources required, and milestones. In true calc fashion the critical path can be changed to take into account changes in resources – more Irishmen hired, a compressor stolen, for example – or unexpected delays. Once the output has been tarted up using *LISADraw*, the results are well up to management consultancy standards. ▷

WHICH SIDE OF THE BLANKET?

Julian Allason examines LISA's parentage...

Frowns outweighed smiles as microcomputer folk reacted to the launch of Apple's *LISA* computer last month.

The most maniacal grin adorned the visage of Apple's rugger playing Marketing Director, Keith Hall, as he exhorted his dealers into orgasms of excitement at the prospect of selling the wonder micro.

The details of *LISA*, which will not have come as a very great surprise to readers of this organ, brought a furrow to the brows of competitors. "Now everyone will want integrated software," moaned one small British microcomputer manufacturer. "Look how long that took Apple to develop – and we don't have a fraction of their resources."

Ecstasy was also less than unanimous amongst dealers. "Apple have wrecked the market. I've already had two of my best customers call to put a freeze on further orders. The worst part is that Apple won't even be able to deliver *LISAs* for six months and then not in any quantity," complained one member of the Computer Retailers' Association.

Wry smiles were the order of the day in Uxbridge, headquarters of Xerox, makers of *LISA*'s only competitor, the 8010 workstation, otherwise known as the *Star*. As noted elsewhere on these pages, *LISA* owes much of its heritage to work done at Xerox's Palo Alto Research Center. Work that culminated in the *Alto* prototype user friendly computer. From the *Alto* – so far the only personal computer to have achieved true cult status – sprang from the aforementioned *Star*.

When industry pundits take a step back from the trees to inspect the wood, they will notice something very odd. Working from the same starting point, Apple reached a very different – one is tempted to say the opposite – conclusion from Xerox. For the *Star* is viewed by Xerox as a workstation for their *Ethernet* local area network. Apple, on the other hand, are adamant that *LISA* is a one-man machine, a *personal* computer that will adorn the desk of professional managers.

It is a curious conflict and one is tempted to wonder whether both companies can be right.

In truth not even Apple are convinced that they enjoy a monopoly of wisdom. As one senior manager remarked, after looking round to ensure that we were not being overhead, "In scientific circles the very best rows start with opposing conclusions being drawn from the same data..."

But it may not even be a two sided argument, because VisiCorp, whose *VisiON* operating environment has received the rough edge of Apple's corporate tongue, think they are dealing with a very different sort of animal. If one could reconstruct the chain of evolution of the concepts first developed at Xerox PARC and Stanford University, it might go something like this: *Alto* user friendly personal computer becomes the *Star* workstation, a single component in a network of stations sharing printing and file storage resources, but its principal function is to exchange information.

As a personal computer company, Apple find other aspects of the *Alto* more sympathetic. The use of multiple screen windows, the mouse as a pointer to them, and of icons (small graphic symbols) to indicate the status of the work in hand all appeal. The network emphasis less so. Apple see the integration of the most popular office applications as a means of closing the gap between computers and office functions as they are normally (i.e. manually) carried out.

The Xerox Star (above) was the first workstation to employ the multiple-window technique. More recently Visicorp announced VisiON for the IBM PC.

At the bottom of the chain, or at least as far down as we can see for the nonce, is VisiCorp. In their world view the PARC concept is primarily a means of making applications programs more user friendly. Not surprisingly, the first programs to receive the *VisiON* treatment will be *VisiCalc*, *VisiWord*, *VisiPlot*, *VisiTrend*, *Visi etc*. And least anyone deprecate that, your correspondent would like to add that he was enormously impressed the first time he sat down with *VisiON*. Moreover, the system has received the imprimatur of mega-mini-computer-maker Digital Equipment Corporation. In the computer world this is the equivalent of not just a feather in the cap for VisiCorp, but a whole bird in their bonnet.

Whether future micro biological expeditions down this particular evolutionary train will be warranted in the future remains to be seen. Certainly there are some interesting growths under culture in the labs of Microsoft and Digital Research. Our microscopes will be trained in their direction over the coming months... ○

LISA—AN EXPENSIVE LADY?

In counterpoint to the otherwise noisy proceedings at *LISA*'s launch was the silence that greeted the announcment of the price – the sterling equivalent of $10,000 plus travelling expenses.

With the pound sick, and the gnomes tremulous, that translates to something like £7,500 – a lot of anyone's money for what is still essentially a personal computer. Have Apple blown *LISA*'s chances then?

Some of the more cynical dealers thought not. "No one knows better what the market will bear than Keith Hall," remarked one computer retailer, who had known the rugger-playing Sales Director in his incarnation as Commodore's marketing mafioso. The existence of a market at that sort of price level is certainly not in doubt. Xerox have demonstrated that by selling every 8010 work station – the only piece of hardware remotely comparable to *LISA* – at over £11,000 each.

The other conclusion reached by the trade, after the customary head scratching, was that when *LISA* does arrive it could be in short supply. Indeed Apple have already indicated their intention of restricting *LISA* dealerships to a select few. The official explanation is that only the most experienced business systems houses would be able to do justice to the new baby. Quite how this squares with Apple's claim (probably justifiable) that *LISA* is so easy to use that it can be learned in twenty minutes, is anyone's guess.

Rumour, that oft ill-informed lady, has it that the original UK target price was £6,500; that was before the gnomes weighed in and sterling tumbled. There seems also to have been geniune disagreement on price within Apple. Sources close to the company's Cupertino headquarters talk of two distinct schools of thought, one favouring a 'low' price around the $8,000 mark with a view to maximising the company's advantage in being first. A second group is said to have canvassed a $12,000 price tag on the basis that this would generate the optimum revenue, given the inevitable supply problems during the first year.

In the event, Apple's chief executive, Mike Markkula, seemed to have split the difference, conscious perhaps that *LISA*'s market lead had been whittled down by successive software delays.

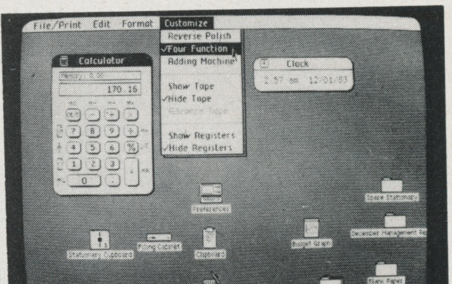
The unknown factor in the *LISA* price equation is *Macintosh*, *LISA*'s little brother. The conumdrum now entertaining Cupertino's corporate types is this: how cheaply can we make Little Mac?

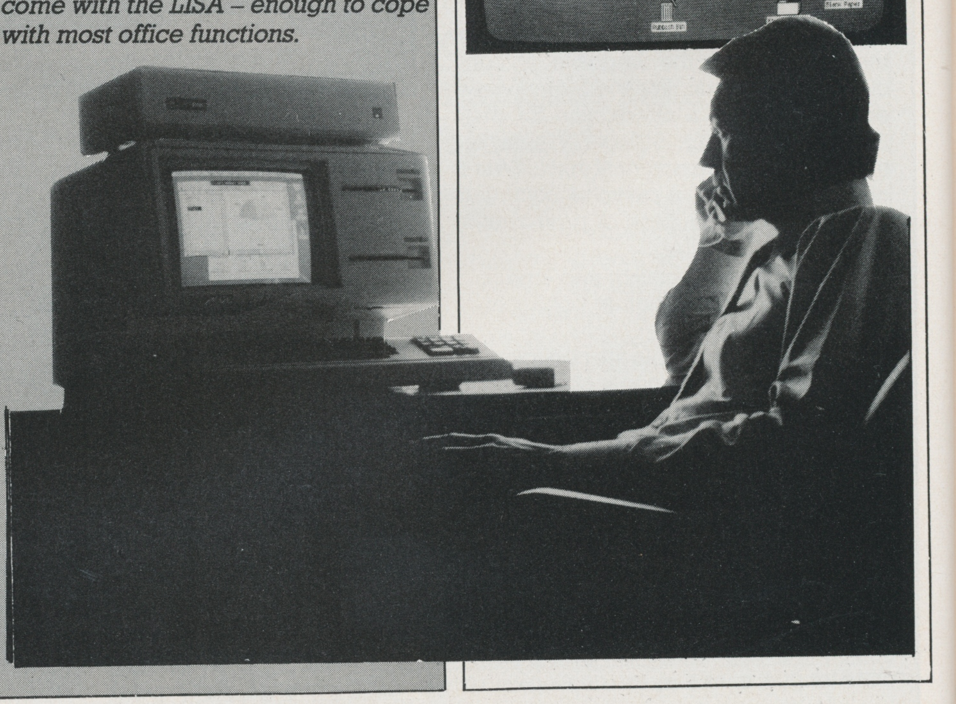
Like *LISA Macintosh* is based on the Motorola 68000 16-bit microprocessor. Like *LISA* it should run much the same software. But will it? Like Topsy, *LISA*'s software just grew and grew and now occupies more than two megabytes of memory in all. Any possibility of marketing a floppy only version of *LISA* went out of the window more than a year ago; hence the presence of the separately boxed *Profile* five megabyte hard disk. Exactly the same problem now arises with Little Mac.

One theory now current amongst Apple watchers proposes $10,000 as an artificially high price for *LISA*, simply in order to maintain market separation from *Macintosh*. All this speculation – for speculation it largely is – is based on the assumption that *LISA* is overpriced. But is it? Try as one may, it is hard to put together a 68000-based system with Hi Res graphics, a megabyte of RAM, five megabytes of Winchester storage and half a dozen or so applications packages and still find oneself with much change from £8,000. And what price user friendliness?

"LISA is the answer to a dealer's prayer: half our costs are in teaching customers how to use the computer" Mike Sterland, Managing Director of Personal Computers, doyen of Apple dealers.

LISA may not be within reach of everyone's pocket, but it certainly looks like good value to me. ○





Six standard business packages come with the LISA – enough to cope with most office functions.

◁ The last application is *LISAList* which is really a sort of database for dumbos. I'm not sure why it's been billed as a list management package as several of the more standard mailing list functions seem to be missing; ditto a proper report generator.

Apple would probably argue that *LISAList* is intended for general use rather than high powered mailing or database management. Packages dedicated to precisely these applications may be expected sometime in the future. Quite when, however, remains a bit of a mystery. As I write, more than a month after the launch, the *LISA* development toolkit has yet to appear, and latest word is that it is unlikely to be before June. Without it third party software houses are going to have difficulty writing any applications programs that exploit *LISA*'s true capabilities. Without those programs *LISA* could turn into a seven month wonder.

The computer supports Pascal, BASIC, and COBOL languages so the problems are hardly insoluble. The onus must also be on Apple to get out and sell *LISA* in quantity. These selfsame software houses subscribe to a strictly commercial code. Commandmant 1 of this states that 'Thou Shalt Only Convert Software for Machines with a Large User Base'.

So different and so special is *LISA* it can truly be said to have a user base of zero.

But perhaps not for long. I, for one, have placed my order. ○

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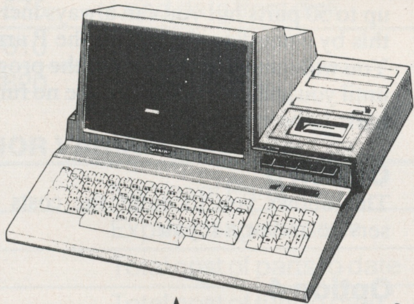

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MOTORING ECONOMY

In these days of soaring prices at the petrol pumps and garage bills as long as telephone numbers, keeping an accurate track of your cars expenses is becoming more important. This month's free program listing written by *Bob Chappell* will keep you better informed and hence could save you pounds.

If it is the first time you have run the program, you will be asked to enter the original milage reading. If you have run the program previously, the program will request the name of the disk file where the history data is stored.

The program then displays its option menu:-

1. Fuel update.
2. Replacements update.
3. Servicing and repairs update.
4. Statistics.
5. Checkups due.
6. Exit the program.

Option 1

The program reports the previous milage reading and asks you to enter the current reading. If you enter a reading which is less then the previously recorded one, the program warns you and you have the choice of continuing (you may be trying to adjust an earlier error) or returning to the menu.

You will be asked to enter the total number of gallons of petrol purchased since the last reading, together with the total cost of the petrol.

Option 2

You will be asked to enter the name of the part being replaced, the cost of the replacement and the estimated life (in miles) of the part. The program can hold up to 50 parts but you can always increase this by extending the size of the P arrays. You will remain in this part of the program until you indicate that there are no further parts to be entered.

Option 3

This allows you to enter the costs of a service and/or a repair.

Option 4

This option displays the following statistics:-

1. Total milage to date.
2. Petrol used to date.
3. Average miles per gallon to date.
4. Petrol costs to date.
5. Service costs to date.
6. Repair costs to date.
7. Parts replacement costs to date.
8. Total costs to date (total of 4-7 above).
9. Original milage reading.
10. Current milage reading.

Option 5

The program will ask you if you want a full list of all information on checkups or just a list of those parts whose milage expiry date has passed. In addition, the program gives you the opportunity to weed out any 'dead wood' in this data.

The list will show the current milage reading and the expiry milage reading of the part.

Option 6

Having elected to leave the program, you will first be asked if you want to save the data to disk (the disk read and write routines are easily converted to use tapes instead of disks). The saved file will be called MOTOR plus the current date.

With good use, this program should help you to keep a watchful eye on your motoring expenses and perhaps save enough money to buy that new model!

MAJOR ROUTINES

25-60	Obtain current date and read in history file.
65-120	Option menu
125-175	Fuel update
180-250	Parts update
255-310	Service/repair update
315-390	Statistics
395-490	Checkups due
495-525	Save data to disk
530-575	Load data from disk
580-610	Exit program
615-620	Pause routine

MAJOR VARIABLES

P$()	Names of Parts
P()	Expiry milage of parts
TP	Total cost of parts to date
FC	Total cost of fuel to date
TR	Total cost of repairs to date
TS	Total cost of servicing to date
BR	Original milage reading
PR	Previous milage reading
CR	Current milage reading
TM	Total miles to date
TF	Total fuel used to date
LD$	Previous date of recording
CD$	Current date of recording

```
5 REM*** MOTORIST'S MONITOR ***
10 REM*** BOB CHAPPELL *** 26/1/83 ***
15 CR$=CHR$(13):LD$="0/0/0":DIMP$(50),P(50)
20 FORJ=1TO50:P$(J)="*":NEXT
25 REM*** IS THIS FIRST RUN ***
30 PRINT"C      MOTORIST'S MONITOR"
35 PRINT:PRINT"PLEASE ENTER THE DATE IN ANY FORMAT"
40 PRINT:INPUT"YOU WISH";CD$
45 PRINT:PRINT"HAVE YOU PREVIOUSLY SAVED ANY DATA"
50 PRINT:INPUT"ON DISK (Y/N)";A$:IFA$="Y"THENGOSUB535:GOTO70
55 PRINT:PRINT"WHAT WAS THE ORIGINAL MILEAGE ":PRINT:INPUT"READING";BR
60 PR=BR:CR=BR:LD$=CD$
65 REM*** MENU ***
70 PRINT"C      MOTORIST'S MONITOR"
75 PRINT:PRINT:PRINT:PRINT:PRINT" 1.  FUEL UPDATE."
80 PRINT:PRINT" 2.  REPLACEMENTS UPDATE."
85 PRINT:PRINT" 3.  SERVICING/REPAIRS UPDATE."
90 PRINT:PRINT" 4.  STATISTICS."
95 PRINT:PRINT" 5.  CHECKUPS DUE."
100 PRINT:PRINT" 6.  EXIT FROM THE PROGRAM."
105 PRINT:PRINT:INPUT"YOUR CHOICE IS NUMBER";N
110 IFN<1ORN>6THENPRINT:PRINT"SORRY - NO SUCH OPTION.":GOSUB620:GOTO70
115 ONNGOSUB130,185,260,320,400,585
120 GOTO70
125 REM*** FUEL UPDATE ***
130 PRINT"C":PRINT
135 PRINT"MILEAGE READING ON ";LD$:PRINT:PRINT"WAS";PR
140 PRINT:INPUT"ENTER LATEST MILEAGE READING";CR
145 IFPR<CRGOTO160
150 PRINT:PRINT"CURRENT READING ISN'T HIGHER THAN OLD   READING.
155 PRINT:INPUT"DO YOU WANT TO GO ON (Y/N)";A$:IFA$<>"Y"THENRETURN
160 PRINT:INPUT"ENTER NUMBER OF GALLONS BOUGHT";NG
165 PRINT:PRINT"ENTER COST OF THE";NG;:INPUT"GALLONS";PG
170 NM=CR-PR:TM=TM+NM:TF=TF+NG:FC=FC+PG
175 PR=CR:LD$=CD$:RETURN
180 REM*** REPLACEMENTS UPDATE ***
185 PRINT"C";TAB(12);"REPLACEMENTS":PRINT
190 K=0:FORJ=1TO50:IFP$(J)="*"ANDP(J)=0THENK=J:J=50
195 NEXT:IFK<>0GOTO205
200 PRINT"SORRY - NO MORE ROOM FOR REPLACEMENTS.":GOSUB620:RETURN
205 PRINT:PRINT"WHAT IS THE NAME OF THE PART YOU HAVE"
210 PRINT:INPUT"REPLACED";P$(K)
215 PRINT:PRINT"WHAT WAS THE TOTAL COST OF THE"
220 PRINT:PRINTP$(K);:INPUTA:TP=TP+A
225 PRINT:PRINT"WHAT IS THE MILEAGE LIFE OF THE"
230 PRINT:PRINTP$(K);:INPUTA:P(K)=CR+A
235 PRINT:INPUT"ANY MORE TO BE ENTERED (Y/N)";A$
240 IFA$="Y"GOTO185
245 IFA$="N"THENRETURN
250 GOTO235
255 REM*** SERVICING/REPAIRS UPDATE ***
260 PRINT"C";TAB(8);"SERVICING/REPAIRS":PRINT
265 PRINT:PRINT"DO YOU WANT TO ENTER SERVICING (S)"
270 PRINT:INPUT"OR REPAIRS (R) COSTS";A$
275 IFA$<>"S"ANDA$<>"R"GOTO265
280 PRINT:PRINT"WHAT WAS THE COST OF THE":PRINT
285 IFA$="S"THENINPUT"SERVICE";A:TS=TS+A:GOTO295
290 IFA$="R"THENINPUT"REPAIRS";A:TR=TR+A
295 PRINT:INPUT"ANY MORE COSTS TO BE ENTERED (Y/N)";A$
300 IFA$="Y"GOTO260
305 IFA$="N"THENRETURN
310 GOTO295
315 REM*** STATISTICS ***
320 PRINT"C";TAB(12);"STATISTICS"
325 PRINT:PRINT"MILEAGE TO DATE";TAB(30);TM
330 PRINT:PRINT"GALLONS OF PETROL TO DATE";TAB(30);TF
335 PRINT:PRINT"AVERAGE MPG TO DATE";TAB(30);:IFTF=0THENPRINT" 0":GOTO345
340 PRINTINT((TM/TF)*100)/100
345 PRINT:PRINT"PETROL COSTS TO DATE";TAB(30);FC
350 PRINT:PRINT"SERVICE COSTS TO DATE";TAB(30);TS
355 PRINT:PRINT"REPAIR COSTS TO DATE";TAB(30);TR
360 PRINT:PRINT"REPLACEMENT COSTS TO DATE";TAB(30);TP
365 PRINT:PRINT"TOTAL COSTS TO DATE";TAB(30);TS+TR+TP+FC
370 PRINT:PRINT"ORIGINAL READING";TAB(30);BR
375 PRINT:PRINT"CURRENT  READING";TAB(30);CR
380 PRINT:PRINT"       PRESS SPACE WHEN READY"
385 GETA$:IFA$<>" "GOTO385
390 RETURN
395 REM*** CHECKUPS DUE ***
400 PRINT"C";TAB(10);"CHECKUPS"
405 PRINT:PRINT"DO YOU WANT ONLY THOSE NOW DUE (D) OR"
410 PRINT:INPUT"A FULL LIST (F)";A$
```

Clear Screen is indicated by PRINT 'C'

96 ▷

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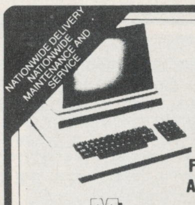
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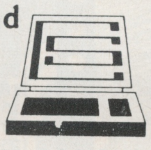
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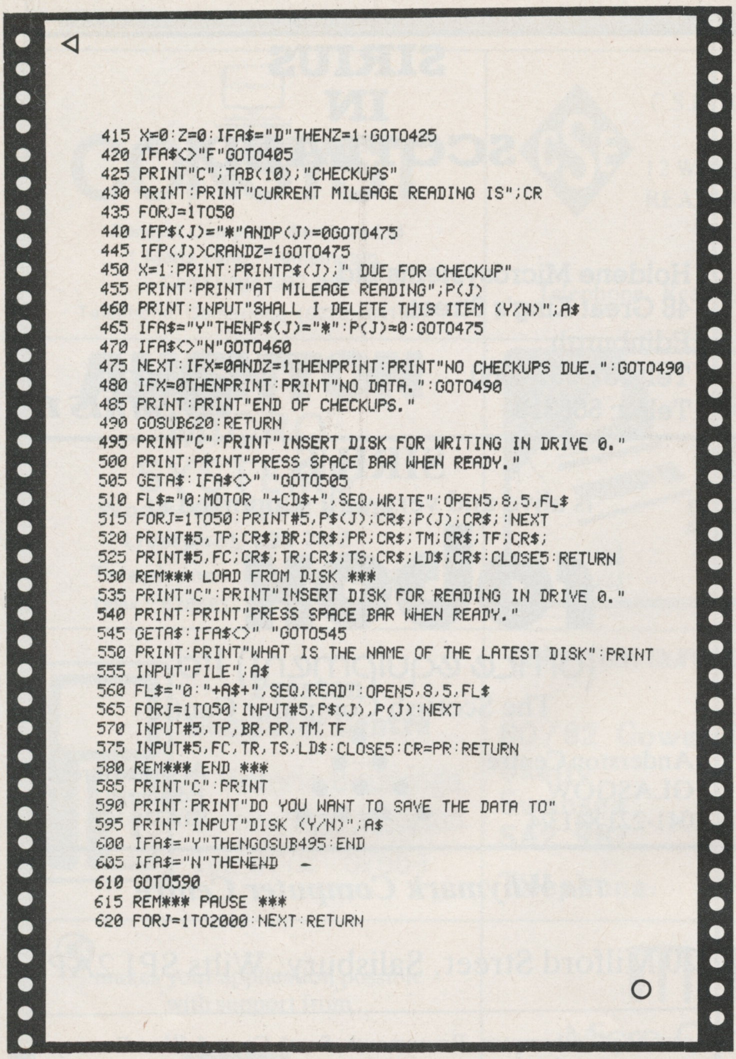

```
415 X=0:Z=0:IFA$="D"THENZ=1:GOTO425
420 IFA$<>"F"GOTO405
425 PRINT"C";TAB(10);"CHECKUPS"
430 PRINT:PRINT"CURRENT MILEAGE READING IS";CR
435 FORJ=1TO50
440 IFP$(J)="*"ANDP(J)=0GOTO475
445 IFP(J)>CRANDZ=1GOTO475
450 X=1:PRINT:PRINTP$(J);" DUE FOR CHECKUP"
455 PRINT:PRINT"AT MILEAGE READING";P(J)
460 PRINT:INPUT"SHALL I DELETE THIS ITEM (Y/N)";A$
465 IFA$="Y"THENP$(J)="*":P(J)=0:GOTO475
470 IFA$<>"N"GOTO460
475 NEXT:IFX=0ANDZ=1THENPRINT:PRINT"NO CHECKUPS DUE.":GOTO490
480 IFX=0THENPRINT:PRINT"NO DATA.":GOTO490
485 PRINT:PRINT"END OF CHECKUPS."
490 GOSUB620:RETURN
495 PRINT"C":PRINT"INSERT DISK FOR WRITING IN DRIVE 0."
500 PRINT:PRINT"PRESS SPACE BAR WHEN READY."
505 GETA$:IFA$<>" "GOTO505
510 FL$="0:MOTOR "+CD$+",SEQ,WRITE":OPEN5,8,5,FL$
515 FORJ=1TO50:PRINT#5,P$(J);CR$;P(J);CR$;:NEXT
520 PRINT#5,TP;CR$;BR;CR$;PR;CR$;TM;CR$;TF;CR$;
525 PRINT#5,FC;CR$;TR;CR$;TS;CR$;LD$;CR$:CLOSE5:RETURN
530 REM*** LOAD FROM DISK ***
535 PRINT"C":PRINT"INSERT DISK FOR READING IN DRIVE 0."
540 PRINT:PRINT"PRESS SPACE BAR WHEN READY."
545 GETA$:IFA$<>" "GOTO545
550 PRINT:PRINT"WHAT IS THE NAME OF THE LATEST DISK":PRINT
555 INPUT"FILE";A$
560 FL$="0:"+A$+",SEQ,READ":OPEN5,8,5,FL$
565 FORJ=1TO50:INPUT#5,P$(J),P(J):NEXT
570 INPUT#5,TP,BR,PR,TM,TF
575 INPUT#5,FC,TR,TS,LD$:CLOSE5:CR=PR:RETURN
580 REM*** END ***
585 PRINT"C":PRINT
590 PRINT:PRINT"DO YOU WANT TO SAVE THE DATA TO"
595 PRINT:INPUT"DISK (Y/N)";A$
600 IFA$="Y"THENGOSUB495:END
605 IFA$="N"THENEND  -
610 GOTO590
615 REM*** PAUSE ***
620 FORJ=1TO2000:NEXT:RETURN
```

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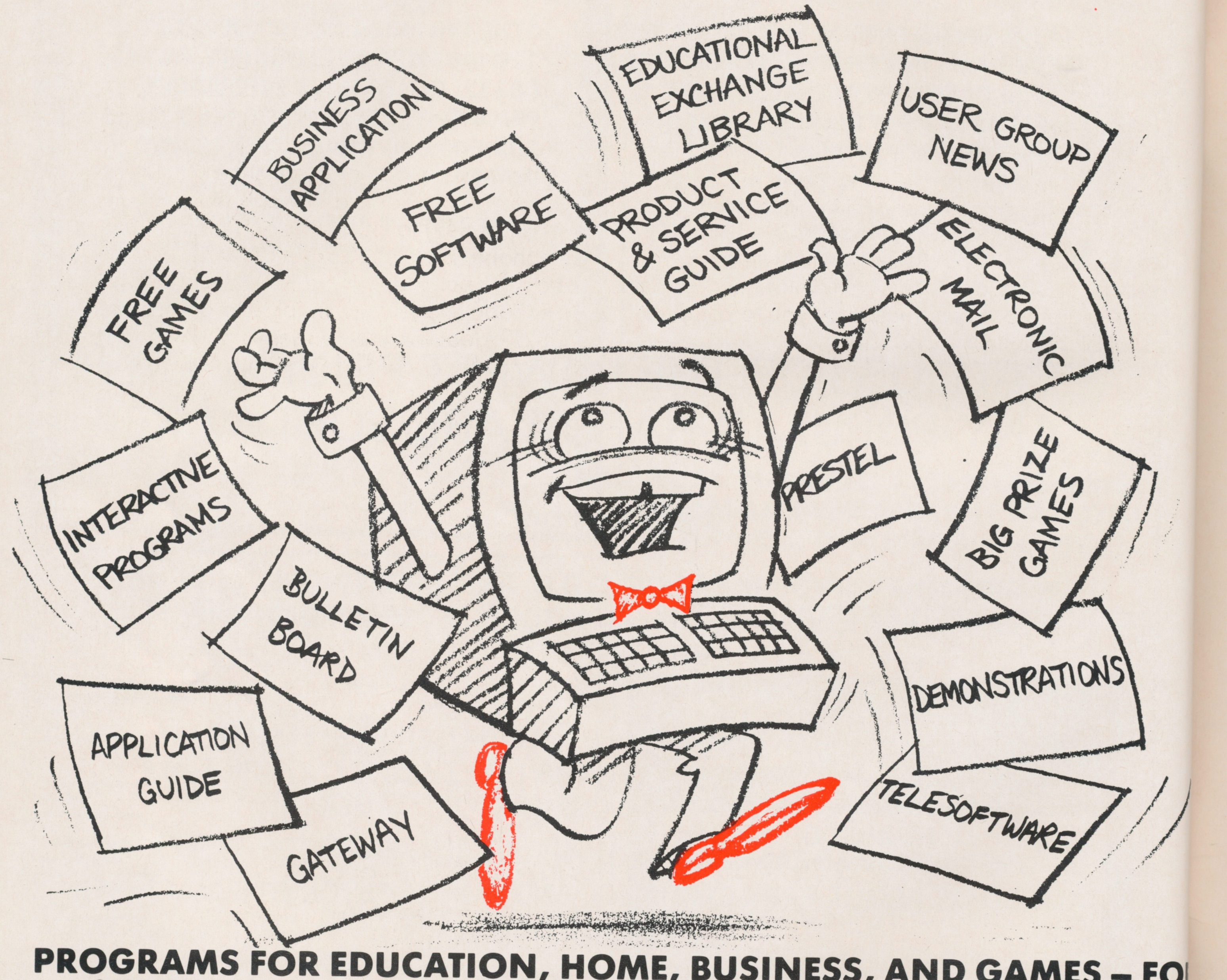
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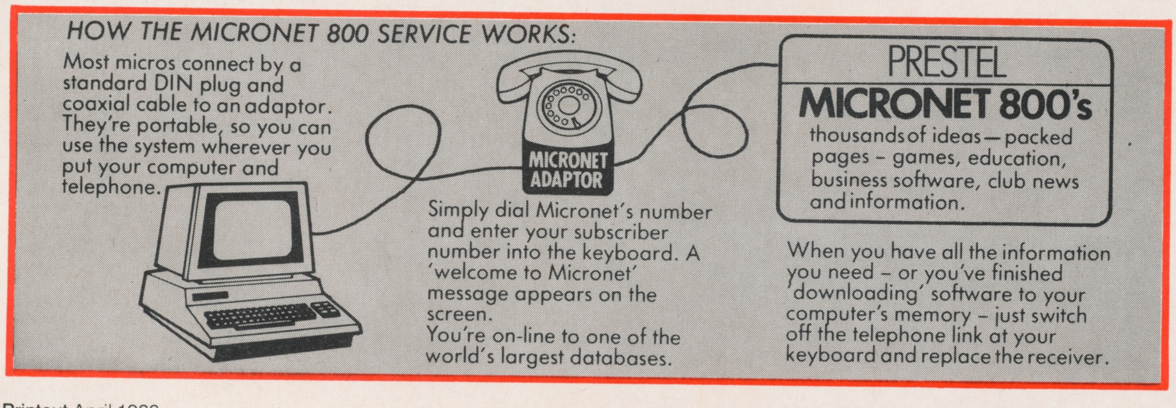
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INSIDE TRADER

Strict disciplinarians and fellow aficionados of the art of Swedish massage will join me in toasting the return of Ivan Siou. Cruelly booted off Prestel for daring to offer an electronic massage guide and saunarama, Ivan is back with a new and improved *Blue Pages* service courtesy of IBM's Viewdata network. Given time this champion of the arts will undoubtedly administer to the philistines and fogies who run Prestel, the discipline they so richly deserve.

A tour of the Old Sewage Farm, where Acorn headquarter themselves, reveals Managing Director and Clive James lookalike, Chris Curry, tinkering with a TV set. It seems the crewcut wonder harbours dreams of broadcasting software to be downloaded via Teletext adaptors. When I mention that Channel Four viewing figures have fallen off the bottom of the scale, a crazed gleam comes into his eyes. I judge it wise to make my adieus.

In response to an invitation to participate in Commodore's *Approved Software Scheme*, Bristol Software Factory's Mike MacDonald has offered to let them join his *Approved Hardware Program*. MacDonald's job function is given as 'Hitman' on his business card.

A clash of titans was anticipated when the micro world's most accomplished exponents of the hyperbolic arts were invited to the same party. But no, Intelligence UK's blond bombshell, Ashley Ward, and Small Systems Engineering's sinister Derek Rowe, got on famously. At eight-thirty the following morning both were on to their publicity agents, Rowe to promulgate a 'merger'; Ward to announce a 'takeover'. A win on points for Ward, I fancy.

Taking the leisurely train route up Mount Snowdon, I am surprised by the apparition of Adda Computer's David Whitehead dangling on the end of a rope, supported by Commodore sales person and fitness-freak Eileen Stroud. With uncharacteristic generosity, it seems The Commodore is rewarding his super dealers with an arduous three-day Outward Bound course. All is made clear, however, when I learn the title of the course: *Survival without equipment* – preparation presumably for still further delays in the delivery of the new Commodore products.

Entries for the Editor's forthcoming Most Tasteless Software Award are flooding in. You will recall that last year's winner, Bomb Buenos Aires *had to be withdrawn from pubs following Questions in the House. I have every expectation of a similar success for Hes Software's* Queen's Bedroom. *The object of the game is to enjoy a bottle of wine in HM's bedroom....*

They no longer hunt heads in Silicon Valley; just mice. Anyone who has every worked for Xerox, or ever been near a mouse is being offered absurd sums by micro manufacturers rabid for rodent technology. Short term, Apple and VisiCorp look set to consolidate their lead. In the long run it is more likely to be Microsoft who set the standard with their Mousey MSDOS-3, code-named MICKEY.

Executives at a certain about-to-be-privatised communications corporation, are bracing themselves for a series of embarrassing detonations. The body in question purchased one copy of ASI's Enquiry *package. Alas, it now emerges that the program contains a self-destruct routine that activates a random number of runs after illicit copies are made.*

To Chateau Commodore, where they are chortling over the following riddle: "What is the difference between a hedgehog and a Range Rover?" *Answer*: "A hedgehog has the pricks on the outside!" Commodore boss, Bob Gleadow, recently acquired a Range Rover.

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We at Silica Shop are pleased to announce some fantastic reductions in the prices of the Atari 400/800 personal computers. We believe that the Atari at its new price will become the U.K.'s most popular personal computer and have therefore set up the Silica Atari Users Club. This club already has a library of over 500 programs and with your purchase of a 400 or 800 computer we will give you the first 100 free of charge. There are also over 350 professionally written games and utility programs, some are listed below. Complete the reply coupon and we'll send you full details. Alternatively give us a ring on 01-301 1111 or 01-309 1111.

ATARI 400 with 16K	**£159**
ATARI 400 with 48K	**£228**
ATARI 800 with 48K	**£349**

400/800 SOFTWARE & PERIPHERALS

Don't buy a T.V. game! Buy an Atari 400 personal computer and a game cartridge and that's all you'll need. Later on you can buy the Basic Programming cartridge (£35) and try your hand at programming using the easy to learn BASIC language. Or if you are interested in business applications, you can buy the Atari 800 + Disk Drive + Printer together with a selection of business packages.

Silica Shop have put together a full catalogue and price list giving details of all the peripherals as well as the extensive range of software that is now available for the Atari 400/800. The Atari is now one of the best supported personal computers. Send NOW for Silica Shop's catalogue and price list as well as details on our users club.

THE FOLLOWING IS JUST A SMALL SELECTION FROM THE RANGE OF ITEMS AVAILABLE:

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Cassettes
Diskettes
Joysticks
Le Stick - Joystick
Misc Supplies
Paddles

ADVENTURE INT
Scott Adams Adv
No 1 Adventurelnd
No 2 Pirate Adv
No 3 Mission Imp
No 4 Voodoo Cast
No 5 The Count
No 6 Strange Ody
No 7 Mystery Fun
No 8 Pyramid of D
No 9 Ghost Town
No 10 Sav Island 1
No 11 Sav Island 2
No 12 Golden Voy
Angle Worms
Deflections
Galactic Empire
Galactic Trader
Lunar Lander
Mountain Shoot
Rearguard
Star Flite
Sunday Golf

AUTOMATED SIMULATIONS
Crush Crumble Cmp
Datestones of Ryn
Dragons Eye
Invasion Orion
Rescue at Rigel
Ricochet
Star Warrior
Temple of Apshai
Upper Reaches Aps

BOOKS
Basic Ref Manual
Compute Atari DOS
Compute Bk Atari
Compute Magazine
De Re Atari
DOS Utilities List
DOS2 Manual
Misc Atari Books
Op System Listing
Wiley Manual

BUSINESS
Calculator
Database Managemt
Decision Maker
Graph-It
Invoicing
Librarian
Mort & Loan Anal
Nominal Ledger
Payroll
Personal Finl Mgmt
Purchase Ledger
Sales Ledger
Statistics 1
Stock Control
Telelink 1
Visicalc
Weekly Planner
Word Processor

CRYSTALWARE
Beneath The Pyram
Fantasyland 2041
Galactic Quest
House Of Usher
Sands Of Mars
Waterloo
World War III

DYNACOMP
Alpha Fighter
Chompelo
Crystals
Forest Fire
Intruder Alert
Monarch
Moonprobe
Moving Maze
Nominoes Jigsaw
Rings of The Emp
Space Tilt
Space Trap
Stud Poker
Triple Blockade

EDUCATION from APX
Algicalc
Atlas of Canada
Cubbyholes
Elementary Biology
Frogmaster
Hickory Dickory
Inst Comptg Dem
Lemonade
Letterman
Mapware
Maths-Tac-Toe
Metric & Prob Solvg
Mugwump
Music Terms/Notatn
Musical Computer
My First Alphabet
Number Blast
Polycalc
Presidents Of U.S.
Quiz Master
Starware
Stereo 3D Graphics
Three R Math Sys
Video Math Flash
Wordmaker

EDUCATION from ATARI
Conv French
Conv German
Conv Italian
Conv Spanish
Energy Czar
European C & Caps
Hangman
Invit To Prog 1/2/3
Kingdom
Music Composer
Scram
States & Capitals
Touch Typing

EMI SOFTWARE
British Heritage
Cribbage/Dominoes
Darts
European Scene Jig
Hickory Dickory
Humpty Dumpty
Jumbo Jet Lander
Snooker & Billiards
Submarine Commdr
Super Cubes & Tilt
Tournament Pool

ENTERTAINMENT from APX
Alien Egg
Anthill
Attank
Avalanche
Babel
Blackjack Casino
Block Buster
Block 'Em
Bumper Pool
Castle
Centurion
Checker King
Chinese Puzzle
Codecracker
Comedy Diskette
Dice Poker
Dog Daze
Domination
Downhill
Eastern Front
Galahad & Holy Grl
Graphics/Sound
Jax-O
Jukebox
Lookahead
Memory Match
Midas Touch
Minotaur
Outlaw/Howitzer
Preschool Games
Pro Bowling
Pushover
Rabbotz
Reversi II
Salmon Run
747 Landing Simul
Seven Card Stud
Sleazy Adventure
Solitaire
Space Chase
Space Trek
Sultans Palace
Tact Trek
Terry
Wizards Gold
Wizards Revenge

ENTERTAINMENT from ATARI
Asteroids
Basketball
Blackjack
Centipede
Chess
Entertainment Kit
Missile Command
Pac Man
Space Invaders
Star Raiders
Super Breakout
Video Easel

ON LINE SYSTEMS
Crossfire
Frogger
Jawbreaker
Mission Asteroid
Mouskattack
Threshold
Ulysses/Golden Fl
Wizard & Princess

PERIPHERALS
Centronics Printers
Disk Drive
Epsom Printers
Program Recorder
RS232 Interface
Thermal Printer
16K Memory RAM
32K Memory RAM

PERSONAL INT from APX
Adv Music System
Banner Generator
Blackjack Tutor
Going To The Dogs
Keyboard Organ
Morse Code Tutor
Personal Fitness Prg
Player Piano
Sketchpad

PROGRAMMING AIDS from Atari
Assembler Editor
Dsembler (APX)
Microsoft Basic
Pascal (APX)
Pilot (Consumer)
Pilot (Educator)
Programming Kit

SANTA CRUZ
Basics of Animation
Bobs Business
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Graphics Machine
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- COMPETITIVE PRICES — our prices, offers and service are very competitive. We are never knowingly undersold, and will normally match any lower price quoted by our competitors.
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SILICA SHOP

FREE LITERATURE

am interested in purchasing an Atari 400/800 computer and would like to receive copies of your brochures and test reports as well as your price list covering all of the available Hardware and Software:

Name ....

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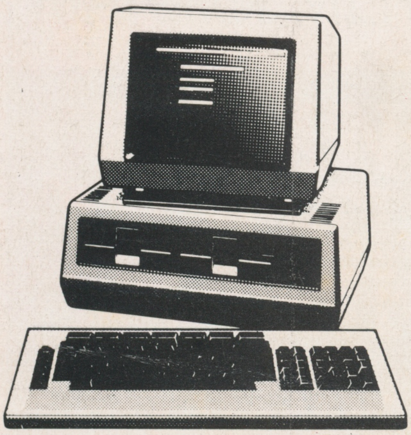
Postcode ....

MCP 04/83

STACK Computer Services

ACT Sirius 1



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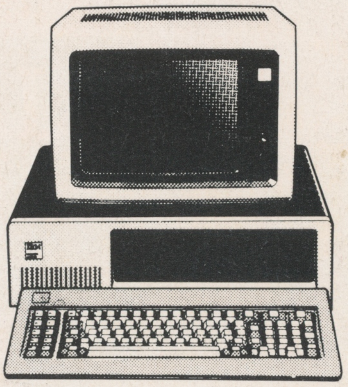

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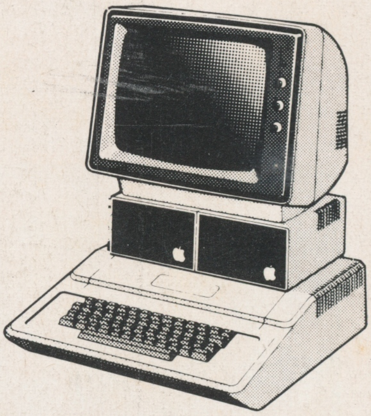

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